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[OFFICIAL NOTICE.]

Twenty-first Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 6, 1898.

To the Members of the Western Gas Association: The twenty-first annual meeting of the Western Gas Association will be held at Detroit, Mich., May 18, 19 and 20, 1898, and will be called to order by the President, Mr. James T. Lynn, at 9:30 A.M., Wednesday, May 18.

The Russell House has been selected as headquarters, and the sessions will be held in a suitable room contained therein. The Executive Committee has arranged for the presentation of the following papers:

"The Enrichment of Coal Gas," by Mr. George H. Harper, Altoona, Pa.

"The Use of Gas for Purposes other than Lighting," by Mr. C. W. Blodget, Brooklyn, N. Y.

"The Igniting of Gas by Static Electricity," by Mr. Bankson Taylor, St. Paul, Minn.

"Recent Developments in Texas of Interest to the Gas Man," by Mr. Thos. D. Miller, Dallas, Tex.

"Methods of Estimating the Values of Gas Liquors," by Mr. O. O. Thwing, St. Louis, Mo.

"The Prepayment Meter," by Mr. C. H. Raynor, Adrian, Mich.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N. Y.

"Some English Correspondence upon Isolated Generators for Bench Firing," to be read by Mr. G. Treadway Thompson, New York City.

The Michigan Passenger Association, the Trunk Line, the Central Passenger Association, the Southern Passenger Association and the Western Passenger Association, from points in Eastern Committee and Trans Missouri Committee territories, have granted rates of 1½ fare for the round trip, conditional on the presentation to the Secretary of 100 certificates for indorsement. The territory covered by the above Associations includes all States east of the Missouri and Mississippi rivers, except the New England States. It is further to be noted that the reduced rate applies to the following States and Territories west of the Mississippi and Missouri rivers: Kansas, Nebraska, Colorado, Utah, Wyoming, Oklahoma, Indian Territory and Missouri.

All persons attending the meeting should purchase a first-class ticket at starting point, paying full fare for same and obtaining from the agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Detroit, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate, returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but the certificates may be obtained on request, provided the notification is made in time. Persons outside the territory covered by the Passenger Associations named above should purchase a ticket to nearest point within said Associations' districts, and from there purchase a ticket to Detroit, obtaining a certificate entitling them to a one-third fare returning to the place from which the certificate was ob-

tained. The Western Passenger Association for the first time has granted reduced rates, on the certificate plan, from territory east of the Missouri river and west of Chicago, Peoria and St. Louis. It is to be hoped that this will induce members in the territory named to attend the meeting, and that it will influence other gas men not members to join our Association.

Do not travel to Detroit on mileage tickets; it is just as cheap to obtain a certificate. Nearly one-fourth of those who attended our meetings the last few years used mileage books, which practice interferes in extending the territory in which reduced rates are obtainable.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us and to participate in the discussion of papers presented.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail applications to those who desire to become members of the Association. JAMES W. DUNBAR, Sec.

[OFFICIAL NOTICE.]

Wrinkle Department, Pacific Coast Gas Association.

MERCED, CAL., March 11, 1898.

To the Members of the Pacific Coast Gas Association: At the last meeting of the Pacific Coast Gas Association to me was delegated the duty of collecting and presenting any matter, in the shape of original ideas or special devices, which may come under the head of "Wrinkles," to be presented in proper form for the benefit of the Association at the next regular assembly.

Many of our members having charge of gas plants on the Coast have many plans, that are practical, handy and labor-saving, which many others by force of circumstances have never seen, but who, on presentation of the device, drawn and described, or through the medium of our official organ (the AMERICAN GAS LIGHT JOURNAL), would gladly embrace the opportunity, and put into practice a plan very beneficial—which perhaps had been in use in some obscure place many years, used exclusively by one man—that would, when given daylight, benefit the whole gas fraternity.

On reading this communication, please see if you have not forgotten something in the shape of a "Wrinkle," that is doing good service in your works, that would be of great importance to the Association. Your answer to this will greatly oblige.

GEORGE H. HOLLIDGE,
Editor "Wrinkle" Department.

BRIEFLY TOLD.

MEMORIAL MINUTE, MR. GEORGE D. CABOT.—At the March meeting of the Society of Gas Lighting, the following minute to the memory of Mr. George D. Cabot was adopted:

George D. Cabot, a member of this Association, died at his home, in Lawrence, Mass., on the morning of January 18th, 1898, in the 86th year of his age.

His connection with the gas industry of the country dates back many years, as Agent of the Lawrence Gas Company, of Lawrence, Mass.

He was identified with several gas associations, having served as President of the New England Association of Gas Engineers, also of the Guild of Gas Managers, of New England, and became a member of the American Gas Light Association in 1874. Mr. Cabot, in all the relations of life, exemplified in a remarkable degree that sterling integrity of character, that honesty of purpose, that dignity of manhood, that naturally placed him in the foremost rank of honored men.

For several years he has not been able to attend our monthly gatherings, and we have and shall long miss his genial presence and his words of wisdom which the older members of this Society remember so well. We place this simple minute on our records, and with kindly remembrance will ever emulate his example.

A. B. SLATER,
CHAS. F. PRICHARD,
HENRY B. LEACH,
} Committee.

NOTES.—We regret to report the death of Mrs. Margaret Young, the esteemed wife of Mr. Robert Young, of the Allegheny (Pa.) Gas Company, whose demise occurred on the afternoon of the 9th inst.——The proprietors of the Ogden Gas Company, of Chicago, have determined to double the generating capacity of the plant.——According to the report of Mr. W. P. Knowles, Superintendent of the Richmond (Va.) city gas works, the output for the year amounted to 213,597,400 cubic feet. The unaccounted-for gas is returned at 9½ per cent. The Superintendent recommends that a new holder, rated to store 1,000,000 cubic feet, be constructed as soon as possible; but the Superintendent has recommended this before, without avail.

[Continued from page 578.]

PROCEEDINGS OF THE MEETING OF THE TEXAS GAS AND ELECTRIC LIGHT AND OF THE TEXAS STREET RAILWAY ASSOCIATION.

HELD AT LAREDO, TEXAS, MARCH 9TH to 12TH, 1898.

FIRST DAY, EVENING SESSION.

The convention was called to order at 8 P.M., by President Fuller, after some fine music had been rendered by the Mexican National Band, First Regiment Mexican Artillery, the presence of which body was attributable to the courtesy of President Porfirio Diaz, of the Mexican Republic, who instructed the Band to visit Laredo on the occasion of the convention as a mark of his sympathy with the objects of the delegates.

A TESTIMONIAL TO PRESIDENT DIAZ.

Mr. Monroe—As a token of our esteem for the courtesy extended, I move that the Association convey to President Diaz, of the Republic of Mexico, our appreciation of the kindness shown us, and that, in thanking him, we have the sentiment as expressed by this body conveyed on a silver plate properly and fittingly engraved.

Mr. Drake—I hardly think that I ever arose with more sentiment, with more heart feeling, to second a motion than I do this. It occurred to me this evening as I listened to the music of this magnificent band, whether the President of our own Nation would take that same interest in the little work that we are trying to carry on here in the lower portion of Texas, on the border land of our Republic, that the President of the great nation of Mexico has taken. Many years ago, when it was first my privilege to visit the City of Mexico, two things impressed me: First, the congeniality and hospitality of the Mexican people; second, their love of music. In writing of my trip to an Eastern journal I said that they first taught music and then mathematics in Mexico. That they teach music you all have had demonstrated to you in the last few moments. I take great pleasure in seconding the motion of Mr. Monroe, and I hope that when the map of the Twentieth Century is made there shall be no Mexico and no United States; but in their stead one grand Republic which, in its glory and exemplification, shall afford to the world a model that history shall never fail to hold up to the coming generations.

The motion was carried.

At this point Mr. J. R. Cox, of Galveston, Texas, read a paper on "Electrical Currents," and afterwards performed some interesting experiments with acetylene gas. In connection with the acetylene exhibition, valuable assistance was given to Mr. Cox by Mr. M. Levy. The convention adjourned, to reassemble at 9 A.M. the following morning.

SECOND DAY, MARCH 10—MORNING SESSION.

The second day's sessions were called to order at 9:30 A.M., March 10th. President Fuller, on motion, appointed Messrs. Monroe, Miller and Chase a committee (with Presidents Drake and Fuller as ex-officio members thereof) to carry into effect the motion adopted the previous evening to suitably convey to President Diaz the appreciation of the Association for courtesies extended.

Mr. George H. Cushman, of San Antonio, Texas, read the following paper on

UNIFORM VOLTAGE AND CONTINUOUS SERVICE.

This ideal state of affairs is the dream of all central station managers, but its realization seems to be just beyond their reach because they can never get the stockholders to see the importance of it in the same light they do. Uniform voltage and continuous service go hand in hand, for you cannot have the one without the other. Why are they so all-important? Because on this kind of service to the public depends the very life of the industry. Who would patronize a station the lights from which are out for a few minutes, or perhaps hours, once a week or once a month, or are continuously going up and down, or are yielding a poor light during those hours when a good light was most needed. An ideal state of affairs means a modern, well equipped station; and by a modern, well equipped station I mean one having duplicate boilers, engines and generators—the boilers being economical generators and the engines economical users of steam, and having close regulation under varying load; the generators being compounded and giving at all times at the switchboard any desired voltage, either 110, 220, 500 or 1,000 volts, or such as the system of distribution calls for.

If a small plant with one circuit, the success of the plant depends almost entirely on the keeping of that circuit balanced. By that I mean

having a good, steady source of power to keep the public always in good humor depends more on the line than any other one thing, because no man can lay out a system of mains from a feeder that will not need careful watching. He can equip his plant to deliver a steady and continuous current to a feeder and can tell exactly how much loss there will be at the end of the feeder, but he cannot tell, to save his soul, which main will have the greatest loss within six months. Adopt the national code of wiring, both inside and outside, and it still remains an unknown quality, all depending on the public patronage. After being in operation six months, if it is found that one main is overloaded and voltage low, the common practice is to raise the station pressure to make it good; but there is the biggest piece of folly on record. The proper thing to do is to add more copper to that branch.

Why is it improper to raise the station pressure? I will try to explain. Perhaps up to that time all were satisfied with their bills, everyone being able to tell by the number of lights used that the meter was about correct. The month after the pressure was raised all meters on those mains which were not overloaded ran faster by the per cent. of increased station pressure put on to relieve the loaded district. Then the consumer and the collector fall out, for it is hard to make a man believe he has used 15 to 20 per cent. more light than he did before, and in consequence he loses confidence in the meters and in the manager, if the practice continues. In larger stations, well equipped with good, reliable apparatus and switchboards, it is absolutely necessary that each feeder be automatically controlled for its proper voltage, besides the generators being automatic, as at times more than one feeder operates on the same machine, or all feeders operate off the same buss bars, no two feeders having the same loss at the same time.

Good line construction adds as much to the success of continuous operation as any other feature, and it always needs careful attention; but as in large plants the manager cannot give these details his personal attention he must needs depend on and have a good, reliable superintendent of construction whose judgment should always be followed if possible. A good man takes pride in keeping his end of the business up in first class condition, but such a condition means a continual reconstruction of lines as the business develops, and most stockholders and managers think that lines once properly put up are all right until the feeder becomes overloaded.

I believe that lines well constructed and well protected from lightning, with branch mains and feeders fused properly, with machines protected with automatic circuit breakers and feeder losses automatically controlled, will afford with careful reconstruction of mains as they become loaded, the best means of securing a uniform voltage continuous current to the public, and will always keep the consumer and central station manager on good and friendly terms.

Discussion.

Mr. J. F. Strickland, of Waxahachie, Texas, having been called on to open the discussion, said—I don't know that I am prepared to comment upon the paper, which is directly in line with the theory and practice advanced in many places. The practice is better than the theory. I appreciate the paper. As this is my first time to meet with the Association I feel I am here for the purpose of being edified rather than to edify. Indeed I must admit my inability to comment upon the paper.

Secretary Holmes then read a paper on "Trucks and their Maintenance," by Mr. George D. Hartson. When the Hartson paper had been discussed, on motion of Mr. Drake it was decided to instruct the Committee on Programme to confer with the local Committee of Arrangements to determine whether or not it were possible to complete the business of the Associations by noon of the following day.

Mr. J. H. Fitzgerald, Superintendent of the Houston (Texas) Gas Light Company, read the following paper on

STREET MAIN AND SERVICE PIPE.

I disclaim any attempt at fine engineering problems that are naturally and closely allied to this subject, but propose simply to give an outline of what I believe is necessary in laying and carrying out the actual work to be done.

I fully realize that there will be but little if anything herein entirely new; however, if I can present something, be it ever so small, that will interest or benefit even a small portion of the fraternity, my efforts will have accomplished all that is expected.

In main laying the first thing to be considered is the size of pipe you are going to use; and, second, to secure the proper quality. This is a serious question, and should be decided with both eyes open. The iron in the pipe when fractured should show a dull, gray color, and not sparkle or glisten. Such pipe will work easier and stand a greater jar or strain than pipe of lighter color and harder metal. The metal should be uniform in thickness, and free from any defects that tend to make what is generally called poor pipe. When you find a broken section that shows one fourth inch metal on one side and five-eighth inch on the other, with a cluster of pits, blow holes or cavities extending one-half or two-thirds through the metal, it is time to boycott that foundry. Pipe should be bought under the most exacting specifications, and if it falls below the required standard it should be promptly rejected. Most foundries make good pipe, but all do not; and if you get poor pipe from a foundry once you should not be tempted to buy of them again, even by an offer of a substantial reduction in price, for bad pipe is not cheap at any price. There are exceptions to some rules, but to this rule there is none.

Before commencing work, your grades and depth of trench should be considered and decided on, and every precaution taken to accomplish the work with as few main drips as possible. Next to the naphthaline plague, and the unhappy consumer whose last bill is always the largest, regardless of his efforts to economize, the street-drip nuisance is among the most fruitful sources of annoyance with which gas men have to deal; yet they are a necessary evil. I have in mind a certain locality where I found three main drips at one intersection, and three more within 150 feet of the same corner; to put the six into one cost, for labor, about $20. I felt it was a good investment then, and have not changed my mind, after a lapse of more than three years. Referring to grades, you can safely lay a 10 inch pipe and larger to a less grade than the smaller sizes. It is not good practice to lay small mains with less than 4 inches to each 100 feet in length, while the larger sizes can be laid to a grade of 2 or 2½ inches in the same distance.

If care is taken to have the pipe properly laid on the solid ground there is but little danger of it sinking enough to impair its usefulness, or to cause the company any serious trouble or expense.

The above figures stand for minimum grades, but when the lay of the ground will permit it, these figures should be increased as deemed best. When excavating for a pipe trench, and by any chance or mischance it has been made too deep, the pipe should not be placed on fresh back-filling, no matter how thoroughly it may be tamped. In cases of this kind I would suggest good, heavy blocking, of cypress or other durable timber, to be imbedded in the solid ground, and the pipes laid upon them. Such blocking should be spaced not more than 6 feet apart under large, and 4 feet under small pipe. When doing this class of work it is very desirable to have a profile of the street, also a ground plan of the sewer pipes, if one can be had; and it usually can from the city engineer, for a reasonable consideration. I recall one or two furnished me in this way that were not exactly profiles, for in excavating we unearthed many things that were not dreamt of in the philosophy of the engineer, much less in mine; but for all that they are a great help in most cases.

Everything connected with main laying is important. It is important to have a bell 4 inches deep; this gives plenty of room to yarn the joint well and leave about 2 inches for lead. It is important to have a bell hole large enough to enable the caulker to get all around the pipe without unnecessary trouble; then he has no excuse for not doing good work. The proper yarning and caulking of joints is very important, and it is at times very hard to get men who will do this work just right; but keep changing until you get those who will do it, and do it properly, without being watched. He should drive the yarn *home hard*, and be sure that he does not slight the bottom. When lead is used a good sized roll should be employed and properly adjusted, so that when the joint is poured there will be a fillet of lead to drive back into the bell. This the caulker should do as thoroughly as he does the yarning; and if he "busts" a bell occasionally, look the other way and whistle; it will not happen often. When you get a man who will do this work right you can afford to be liberal with him to a reasonable extent in order to retain his services. There is nothing more foolish or wasteful than doing such work in a careless and slovenly manner, because its defects will be concealed under the ground. Remember, there it remains, a constant drain on, and menace to, your distributing system, until you are eventually forced, by excessive and constant losses, to have the pipe overhauled and the work properly done. When cement joints are made the yarn should be driven in the same as where lead is used, except that it should be well soaked in water before it is put into the joint. Mix the cement (Portland) in the proper quantity, forcing it into the bell with a small trowel, then take another supply of yarn, wetted as before, and drive it in on top of the cement; on the outside of this fill the joint with cement, until it stands out like a heavy moulding at the end of the bell; smooth it off with the trowel and the joint is

made. The cement should be of such consistency that it will not run after being applied. If there is water in the trench it should be kept below the joint until the cement begins to set. I have only used cement on street mains for the last 18 months, but so far I have found it in every way satisfactory.

It is bad practice in new towns, where are no established grades nor paved streets, and few if any underground sewers, to lay gas mains with less than 4 feet of covering. There are many reasons for this. First, you will be lower than the water mains and services; and, second, you will always be deep enough to run your own services with ample grade, thus avoiding the use of service drips. Then when the town gets a sewer system there will be private sewers to houses, catch basin connections, and what not. By being 4 feet down we would escape most of these. Further, where pipe is laid to this depth we in the South have no cause to fear that the joints will be disturbed by expansion. At bridge crossings and open places expansion joints should be used. Lastly, when the streets have to be paved you escape the extraordinary expense of lowering your mains and services, which is always greater than the original cost for labor in putting in the pipe. Doing work in this way is expensive, but it is money well spent.

Pipe for street mains should be tested under pressure before being put into the ground. Although it is pretty certain in advance that you will not find many leaks, still if you find one or two in a mile you are more than paid for your trouble; and if you find none you have sacrificed your time in a good cause. I feel that we are indebted to Mr. John R. Kempf, Jr., of Salt Lake City, for a cheap and convenient appliance for making such tests. It was contributed to the "Wrinkle Department" of the Pacific Coast Gas Association, last summer, and illustrated and described in the AMERICAN GAS LIGHT JOURNAL, Aug. 30, 1897, pages 328 and 329. After the pipe is put into the ground, the work completed, and the gas let in, another test by a lighted torch is a precaution not to be overlooked. This will discover any leaks from defective work or fractures that might be caused in handling after the first test was made. There is no danger attending this test, if the man first makes a trip along the line, as his nose would warn him of any leak sufficiently large to be dangerous. This test is not only for joints but for the entire length of the pipe.

In regard to coating pipe for street mains, I will say that they should be coated on the outside (if it has to be done) with a brush, and I believe after all is said that it is the best way to have it done. I do not advocate dipped pipe, but I am not as much afraid of it as some men of whom I have known and read. Precedents do not always hold good. When a pipe has been in the ground several years and it becomes necessary to replace it with a new and larger one, the pipe so removed, if found in good condition, will always be made to do service in some other locality. My observations have convinced me that the soil has a greater affinity for the uncoated metal, consequently the process of oxidation is much more rapid on uncoated than on coated pipe. This can be readily demonstrated when tapping mains for services.

I do not believe it profitable or expedient from any standpoint to lay pipes, in a growing community, smaller than 4 inch. I cannot understand what temptation there is to use 3-inch pipe when, at an additional cost of 6 to 7 cents per foot, a 4-inch might be used. It is well to bear in mind that the latter has nearly double the sectional area of the former, and will pass more than twice as much gas. In addition to this, after both mains are tapped for an inch service connection, the 4-inch opposes a resistance to cross fracturing of 7,000 pounds greater than the 3-inch. The differences in lead and labor are so small that they need not be taken into account. Then the only extra cost is about 6 pounds of metal per lineal foot; for this you double your capacity to do business, lessen the risk of breakage and consequent leakage, by giving you a stronger pipe that has many advantages over a 3 inch for tapping and attaching services. I am aware of the fact that it is sometimes necessary to economize, yet I would draw the line on 3-inch main. It might do to run in some locality where there is no prospect of any future increase in business, such as running to some public institution that occupies a large tract of land, or an isolated residence under like conditions. In such cases it would be simply a service pipe—nothing more. With the exceptions mentioned, I do not believe any gas company is so poor that it could afford to use 3-inch pipe instead of 4-inch for the difference in cost.

It is generally conceded that all special fittings, such as crosses, tees and elbows, should be made with long, curved bends, and not with square and abrupt angles. Crosses with four bells are preferable to three bells and one spigot. Eighth bends and even sixteenth bends should be carried in stock, to be used whenever a deflection in the line is necessary. The practice of making such turns with straight pipe is very bad, and is almost sure to leave a defective joint. The joint will necessarily be very thick on one side and very thin on the other, besides, the spigot end on one pipe, being diagonally across the bell in the other, obstructs the passage of the gas and causes an unnecessary amount of friction that could and should be avoided.

As wooden gas mains are practically, if not entirely, obsolete, I will not take up the time of this meeting with any further reference to them, and as wrought iron and steel pipes were never used for street mains by me, I will, therefore, leave them to some one better able to deal with the subject.

With reference to that point, I will conclude this part of my subject with an extract from a letter, published in the *Water and Gas Review*, January, 1898 (I presume this will apply to gas as well as water), which is as follows:

"The question of the relative values of cast iron and steel, as materials for water pipes, is an open one, and the answer depends largely upon the requirements of the individual case calling for its use. If strength is the predominant factor required, steel may be found the most suitable at the minimum of cost. Cast iron is certainly the cheaper of the two metals at the present time, except in instances where the great cost of transportation militates against the heavier material. That both materials are entirely suitable for the purpose is evidenced by their general use the world over."

This brings us to the much neglected service pipe, which I shall endeavor to deal with as briefly and as clearly as I know how. My experience satisfies me that the larger per cent. of all unaccounted-for gas comes from defective service pipes, caused by poor workmanship, the ravages of time, and the destructive influences of Mother Earth. I feel quite sure we lose more gas from this source than is lost through slow meters and leaky mains. Service work, therefore, is of prime importance, and that no pains should be spared to have it done, in the first instance, in the best possible manner goes without saying; for it cannot be too well done. Presuming that the average life of a wrought iron service pipe, as it comes from the factory, is from 8 to 10 years, and that by going to a little trouble and expense (very small) it can be made to last for 15 or 20 years, and perhaps much longer, is it not the plain duty of the engineer or superintendent to incur such expenditure? It is not only his duty but to his interest to do so. In order to accomplish this result service pipe should be tested under pressure and coated with some well tried paint or mixture before being put into the ground. After the pipe has been jointed and ready for back-filling, the coating should be applied to all exposed threads, and at places where it has been marged by tools or handling. For some exact and valuable data on this point, I will refer interested parties to two articles or papers, read before the 1896 meeting of the American Gas Light Association, and published in the AMERICAN GAS LIGHT JOURNAL, of Dec. 7, 1896. One of the papers is by Mr. T. Littlehales, of Syracuse, N. Y., on "Service Pipes and Service Piping;" and the other is by Mr. A. C. Humphreys, M.E., N. Y. city, on "Coating Service Pipes."

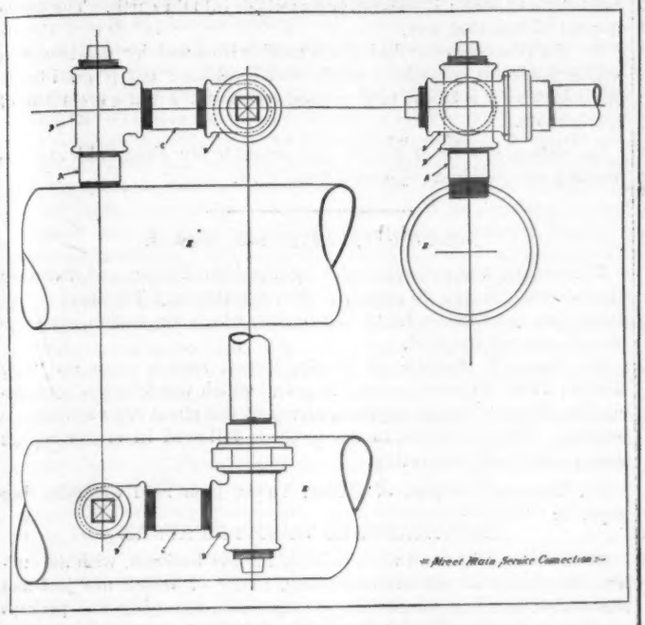
Although these are last year's eggs, they are still fresh and good, and likely to remain so for some time to come. Many companies coat their pipes with coal tar, and a variety of other mixtures having coal tar for their base. I believe the preparation having the best recommendation, and having stood the longest and most satisfactory tests, is that used by the Cincinnati (O.) Gas Light and Coke Company, and given to the public in the paper by Mr. Humphreys already referred to. Now, as it has become an axiom that we cannot get too much of a good thing, I shall reproduce the formula for this mixture for the benefit of those who may have overlooked it when first published. It is as follows:

"Bring a kettle of tar (20 gallons) to a low boiling point, and add 20 pounds of fresh slaked lime, sifted over the top and worked down. Boil down to a paste, or a consistency about midway between tar and pitch. Let it settle for a few minutes, then add 4 pounds of tallow and 1 pound of powdered rosin. Stir until they are thoroughly dissolved and incorporated with the tar, then let it cool and settle. Ladle off into barrels. When ready for use, to each barrel of 45 gallons of the above mixture add 4 pounds of crude rubber, dissolved in turpentine to the consistency of thick cream. Heat the mixture to about 100° F., and immerse the service pipe, heated to about the same temperature."

It is our practice in most cases to tap the main on top and one size smaller than the service pipe proper. Where an inch service is to be used, the main is tapped ¾ inch, and for a 1¼-inch service a 1 inch tap is used. This will give equally as good results and is an undoubted advantage to the smaller sizes of mains, for it greatly lessens the risk of cross breaking. I sometimes use a street main service connection that I consider has some good points, and present herewith a blue print of same.

Referring to the drawing, *A* is a short shoulder nipple; *B* is a plain tee; *C* is a plain nipple; *D* is a union tee; *E* is the street main.

The drawing shows the fittings to be of uniform size, while ordinarily the nipple "*A*," would be ¾-inch, and the tee, "*B*," would be ¾ by ¾ by 1 inch; the balance of the fittings and line being 1 inch, same as center



of *B*. This ¾-inch nipple, being only about 1½ inches long, has the advantage of the main pressure without any appreciable loss from friction. This connection not only gives you a universal joint but enables you, by removing the plugs from the tees, to examine both main and service pipe, and if found necessary you can disconnect the service at the union tee, to make any changes or repairs necessary.

This is cheap and convenient, as nothing but regular fittings and all right hand threads are used.

In connecting service pipe together great care should be exercised in making good joints. The couplings should be removed, and the thread on ends of pipe well painted with red lead mixed with linseed oil, or a mixture of litharge and glycerine. This latter hardens rapidly, and should not be mixed until you are ready to use it. It is a serious question with me if it would not pay to use extra heavy pipe with patent couplings for all services.

When the price of patent couplings is so reduced as to be "within the reach of all," I expect to use nothing else. The present price is nearly four times that of a plain, and three times that of a galvanized coupling, which makes them not only expensive, but unreasonably so.

Services could frequently be improved by using wrought iron bends instead of the plain, short elbows. Pipe less than 1 inch should not be used for services; they are too easily deranged by shifting soil, the effect of traffic and many other minor disturbances. A very small depression will leave a trap that will shut off the gas sooner or later, and a very insignificant internal obstruction will cause a great deal of annoyance to the company by the frequency of "complaints." Besides using gas for light many consumers use it for cooking and heating. An instantaneous water heater, while convenient and economical, needs a good supply of gas when in use. In such cases a ¾-inch service will not prove satisfactory, unless it is very short and under heavy pressure, and even then it is doubtful. In regard to service cocks I am aware that gas men differ as to their value and economy. As local conditions are not always the same, there are several reasons why I consider it good practice to use them. The residence portions of our cities are composed almost entirely of frame houses, and consequently fires are more frequent than where brick and stone prevail. In this case, they are convenient to shut off the gas from the premises when you are unable to get inside. Again, when your service is shut off with water or any other obstruction, it is a simple process to dig down to the cock and find out whether the trouble is in the street or in the yard. This frequently saves several dollars for labor.

We have a good many consumers who go away for the summer and prefer to have the meter left in and pay rent for it. In such cases we always shut the gas off in the street to prevent bills, "just a little larger than when the family were at home." This is not a one-sided question, but I feel satisfied they are worth all they cost and more—at least in Houston. I consider it a good practice to use a clip or clamp for attaching services to small mains. This we have not been doing, but I expect to adhere rigidly to it in the future. Three or four times I have found it necessary to run 2 and 2½-inch services from 3 and 4-inch mains. Instead of tapping the main, I cut it and put in a tee, with a reducing branch for the service connection. This is not given as a good method in general, but there are times and conditions when it is the best thing to do; and I have no doubt but every man in the business has found it necessary, some time in his experience, to do likewise. Extreme caution should be observed in digging the service trench to avoid getting it too deep at any point. A service should lay on the natural solid earth its full length, and if the ground is soft or spongy it should be leveled down, and a good plank, not less than 8 inches wide, laid beneath it; even a wider one would be still better.

Lead pipe is not very generally used for services, and in the United States its use is very limited. Yet much could be said in its favor, and some engineers and managers will use nothing else. It is claimed that, when properly protected in the ground, it gives excellent satisfaction. The claim is no doubt true that they are more durable, present a smoother surface to the gas, causing less friction than an iron pipe, and have comparatively fewer joints.

As a case in point, I will cite the New Orleans (La.) Gas Light Company, which uses nothing but lead pipe and brass fittings in its service work. I am enabled, through the courtesy of Mr. Carroll, Engineer and Manager of the works, to present some facts in regard to the manner of doing this work and its results, and I feel sure they will be interesting to many. He lays all his service pipe in wooden jackets; the ¾ and 1-inch pipe are laid in jackets, 3 by 4 inches, and the 1¼ and 1½-inch in jackets, 4 by 4½ inches in cross section; the jackets are of cypress, and made in halves. Each part has a half-round groove the proper size to fit over the pipe. The trench is dug to grade and the lower half fixed in place. The pipe is then laid in this bottom half and the top nailed on. This work is all done with scrupulous care, and has given good results. Cypress wood does not decay in the wet ground—the ground in New Orleans is full of water—and many lead services thus laid have been in use more than 30 years without ever having given any trouble. Sometimes where the ground is dry the lumber rots and has to be renewed; when this happens it is generally under the sidewalk. The soil is very destructive to iron pipe, which, when used, only lasted from 2 to 4 years, and, of course, was not as economical or satisfactory as lead. All services of ordinary length are laid with only two joints—the one at the street main and at stopcock. Rats will gnaw lead pipe and sometimes destroy or damage it in loose ground or exposed places. And it should be remembered that after it has to be discarded as service pipe it still has some value as scrap lead.

Discussion.

Mr. Miller—In discussing this paper I feel as if Mr. Fitzgerald had given us much that is worth making note of for our practical guidance. Indeed, the paper is very complete. In making cement joints I believe the general course is to dip the first yarn in a grout of cement, before driving it back.

Mr. Fitzgerald—I never did that; I simply wet it.

Mr. Miller—I also find it the practice to put in one lead joint to every four or five, or to every five or six cement joints. I don't know what the local conditions in Houston are, but when we have an extremely dry spell in Dallas we have a large leakage account; the contraction of the soil loosens the joints of the pipe. We make it a practice to begin in the winter, when things are a little dull, right after the first of the year usually, to go over our mains, taking the sections that had not been examined the previous year, this plan being followed systematically with a view to going over entire main system every three years. As to coating pipe. I have just had a little experience therein. While I was always an advocate of the use of coated pipe, I am now more firmly convinced than ever that it is the proper thing to do. I once saw a gas main in St. Louis, which was cut to admit a fitting, that had been in the ground 40 years. That main had been tarred when laid. The inside of the pipe showed no evidence of tar whatever, but on the outside the tar was almost as bright as the day it was put on. There was absolutely no rust on the outside of the pipe. I have just taken up two blocks of 3 inch cast iron mains as it had contracted the habit of breaking every time the rainy weather came, and replaced it with larger pipe. It was laid without any coating, and I doubt very much if that main is worth laying again, although it was taken up in good shape. I think 25 per

cent. of the body is gone in rust. As to wooden mains, to which Mr. Fitzgerald referred, I want to relate an experience therewith in Dallas. When the Dallas gas works were first built, along in '72, wooden mains were laid. Since my time there we took up several joints of that pipe, and some of it was in very good condition, but the gentleman who originally acted as Secretary of the Company said that when gas was first turned on naturally the trial was a momentous one in the city. They turned on the gas and went up town. The citizens began to light up, and as the gas works officials walked along the street they smelled gas. Finally the Secretary stepped out into the street to determine whether or not the mains were leaking. Walking out until he got to the main he struck a match, and the flame went right up all along that street like a torchlight procession; the leakage was about 60 per cent. I think service cocks and a box cost about $1.50 on an inch service, and I believe it always pays to use them. Once in awhile you will get an irate consumer who will not let you into the house—I know there is a legal process to meet that difficulty—but the outside shut-off easily solves the problem, even if the meter is allowed to remain in the house. We left a meter in a house for five years, but I finally got it out. I believe there is no open ground as to the statement that the return current of street railways does affect water and gas mains. Six or eight months after the completion of the electrical car line on Elm street, Dallas, we began to have trouble with our services on that street, and I think we had to renew 50 per cent. of them. The services were leaking and stopping up. We got rid of a good many ¾-inch services during the replacing. That electrolysis can be remedied I have no doubt, although the remedy would be rather an expensive thing for the street car company. In time I think the return currents of street car lines will not be made through the ground at all. While I have used another formula, I think the one given by Mr. Fitzgerald for coating is the best, even if it does require a little more trouble and time to use it.

Mr. Stewart, of the Waco (Texas) Gas Company, being called upon by the Chairman, said: As it happens to be my office with our Company to listen to the gentle admonitions of the people and to patch up the sores between our patrons and ourselves, and while I have been greatly interested in and benefited by Mr. Fitzgerald's paper, I don't think I can add anything to the discussion. I don't think it can be improved upon.

Mr. Miller—I would like to know from some of the street car people present if anything is being done looking to relief from trouble of ground currents acting on the pipe. I know of one instance concerning a lead water pipe and an iron gas pipe, in which the current from the car service was the culprit. The current in leaving the water pipe and coming over to the gas pipe literally dissolved the leaden pipe and deposited it in the shape of an electro plate of lead on the gas pipe.

Mr. Scoville, of Austin, Texas—Some two years ago I had a great deal of trouble with our West 6th street line. Two or three times every week the water company and the Gas Company complained that their pipes were leaking. On investigation I found that the bonds used in laying our rails were simply small iron wires, and I began right away to replace them with good, heavy copper bonds. It is now six months since I had a complaint from either of the companies, and I believe that this trouble can be generally prevented by good bonding and keeping it up; and I believe it can be almost entirely obviated on a smaller system. On larger systems it is customary to run heavy returns and bonding very often.

Mr. Chase, representing a street car company—I think the gentleman will find, if he is on good terms with the street railway company, that the latter often attaches its wires to the pipes, in order to make a better return. Some years ago the opinion prevailed that the only way to make a return was to attach to the water or gas pipes, and the practice was followed without saying anything to the companies. We have bonded our track since the first trouble, which happened a few years ago. Having had some complaints, we re-bonded with a bond large enough for the return. We have never had any complaint since that. I may say we never attached to the water or gas pipe.

Mr. Miller—I know that, ever since the electric street railway car made its advent, it has been customary to bond the lines very heavily, and I never knew there had been any lack of diligence in that direction. But I am surprised to know that small iron wire was ever used on a street car line for bonding. I am even too much of an electrician to do that. With reference to connecting to gas or water pipes it was thought at one time that that was a proper remedy. The mischief, of course, is caused at the point where the current leaves the pipe. In our city a 36-inch water main runs down the street where the feeders run from the power plant, and they have a 3 or 4-inch connection running over there to supply the electric plant with water. I think as long as they used that they had to renew it frequently.

The President—I know there was a great deal of agitation on that subject in Boston. It has been very expensive to them.

Mr. Chase—If they have contact enough, and large enough bonds attached to the rails, there will be no trouble in taking all that current right straight back; it will never go outside into the earth. The whole current will go that way.

Mr. Scoville—A great deal of the trouble is caused by negligence in letting the bonds go without repair after breaking; but if good bonding is kept up it is bound to give good results and avoid a great deal of that trouble.

On motion a vote of thanks was passed to Mr. Fitzgerald, and the meeting was declared adjourned until 2 P.M.

SECOND DAY.—AFTERNOON SESSION.

The meeting was called to order by President Fuller, and Secretary Holmes read the annual reports of the Secretary and Treasurer of the Texas Gas and Electric Light Association, which, on motion, were approved and ordered filed.

Mr. Frank E. Scoville, of Austin, Texas, read a paper on "Car Bodies: Their Maintenance and Repair," which was followed by a discussion of interest to the representatives of the street railway interests present. The references to the methods followed in creosoting ties were particularly interesting.

Mr. Thomas D. Miller, of Dallas, Texas, then read the following paper on

INSTANTANEOUS WATER HEATERS.

Amid all the trials and vicissitudes of the gas business, with the endless complaints of various characters, many of which are just and reasonable, some of which are unreasonable, annoying and perhaps puzzling, making of life a desert covered with a vast array of struggling appliances for the use of gas, it is with delight that the gas manager greets an appliance which elicits expressions of praise and satisfaction from his customers. This appliance is Science's best substitute for Nature's bountiful work, giving to mankind that which nature destined should be the one great preventive and remedy for all the ills humanity is heir to, viz., hot water.

Nothing will bring more benefits (excepting perhaps a full larder) into the household than a convenient and abundant supply of hot water all the time.

The water back in the kitchen range does not do this, although at one time it was the nearest approach to that ideal. The range boiler has really but one virtue to recommend it, that is, to supply hot water in several different places at one time. Its installation is costly and its maintenance expensive, to say nothing of its lack of economy as a means of heating water. Keeping a supply of hot water constantly on hand is a wanton waste of heat, for there a steady radiation from the conveying pipes and boiler goes on continuously. The ordinary 30-gallon boiler has 17 square feet of surface exposed to the air and, with a temperature of 100° to 110°, makes quite a respectable radiator in a warm climate. The circulation in the coils is of necessity slow, and thus allows the water to become heated to a point at which it deposits the lime held in solution on the inner surface of the water back, thereby reducing its efficiency, until it eventually ceases to be of any service, when it must be removed and cleaned at considerable annoyance and expense.

The instantaneous water heater was first introduced in England about 20 years ago. From there it soon found its way to Australia, which country, it would seem, is very progressive in its adoption of improved gas using appliances. In 1884 a heater was introduced into this country from Australia, and, so far as I am able to learn, was the beginning of the instantaneous water heater business in the United States. At any rate the use of this appliance has become so general at this time that by way of comparison the idea was in its infancy at that time.

Naturally many changes have been made in designs and details of construction, but the one general principle of bringing the cold water in contact with, and thinly distributed over, the surface of heated metal, and letting it gradually absorb the heat and pass on to more highly heated surfaces to a discharge pipe, has not been changed. In the accomplishment of this purpose gas is the best adapted fuel, and the success of the heater is due to the use of gas as the fuel.

When the instantaneous water heater was first put on the market the work of education begun, and as its supreme beauty, as a household convenience, became more generally recognized the use of the heater

became more general, so at this date there are from 15,000 to 20,000 heaters in use in the United States.

The most important point in the satisfactory installation of any gas using appliance is an ample supply of gas. With the instantaneous heater it is paramount, for it must be borne in mind that the water is heated in passing over the sheets of metal, and if not heated then to the proper temperature the opportunity of doing so is gone. Therefore, an ample supply of gas is necessary.

In all instantaneous heaters using the Bunsen flame, where a cold surface is constantly presented to the flame, a vent pipe is absolutely necessary, if the heater is to be used in a closed room of the dimensions of the ordinary bath room; and, in any event, it is very much preferable to have the vent pipe. The Bunsen flame coming in contact with the cold surface has its temperature reduced suddenly to such an extent that the complete combustion of the gas is interfered with, so that the products of combustion become water, carbonic acid and carbonic oxide in varying proportions, according to circumstances, instead of water and carbonic acid. Carbonic oxide is a very poisonous gas to inhale, and has a historical place in the annals of the world.

No appliance is made for the use of gas with better material or more care than the best grades of instantaneous water heaters of to-day, as experience has shown that copper and brass only, and an absence of soft solder, are absolutely necessary in the construction of a durable instantaneous heater.

With the use of the best materials and workmanship no instantaneous heater has been constructed that would stand more than a few firings without having a flow of water passing through. It is, therefore, not only desirable but necessary, so that a heater may give satisfactory service, that the water valve shall open automatically prior to the gas valve, and close only after the gas has been turned off.

The water heater, because of its high efficiency, does not consume a large quantity of gas; for, while it uses at a high rate, it accomplishes the work quickly, and is, therefore, not run long at a time. Therein lies its beauty and its strength, for it paves the way to the introduction of other and more extensive appliances.

The instantaneous heater will produce hot water instantly, day or night, of any temperature and for an indefinite time, if desired, at the lowest possible cost.

The different sizes of heaters will, of course, produce more or less hot water according to size, but from the average size heater in ordinary use I obtained the following results, with Dallas gas of 20-candle power, one-half coal gas and one-half water gas, on two different makes of heaters. The tests were made in the houses of consumers, and the heaters have been in use a year or more. No special attention was given the heaters preparatory to making the tests.

The results in the following table are obtained from the following formula:

$$\frac{\text{Number gallons water per hour} \times \text{number degrees F. water was raised}}{\text{Number cubic feet of gas used per hour}} =$$

number of degree gallons per cubic foot per hour, which is taken as a conventional unit for comparison.

Dividing the number of degree gallons by 50, we have the last column, "Equivalent of gallons raised 50° with 1 cubic foot of gas."

Tests of Water Heaters under Practical Conditions. Heaters in Residences in Use a Year or More.

Test Number.	Time of Making Test. Minutes	Consump'n Gas. Cu. Ft.		Temp. Water. Degs. F.		Gallons Water.		Water Raised Degs. F.	Degree Galls. per Cu. Ft. per Hour.	Equivalent of Galls. Raised 50° F. with 1 c.f. Gas
		Actual Cu. Ft.	Cu. Ft. per Hour.	Entering Heater.	Leaving Heater.	Actual Gals. Run.	Gals. per Hour.			
1	5	6.75	81	54	117.0	6.00	72.0	63.0	56.0	1.12
2	.....	.....	81	54	123.0	.....	72.0	69.0	61.3	1.22
3	5	6.75	81	54	101.0	10.50	126.0	47.0	73.1	1.46
4	5	6.50	78	55	98.0	8.50	102.0	43.0	56.2	1.12
5	10	15.00	90	55	105.3	17.00	102.0	50.3	57.0	1.14
6	.....	.....	90	55	110.0	.....	102.0	55.0	62.3	1.25
7	5	7.00	84	56	112.4	5.75	69.0	56.4	46.3	0.92
8	10	14.00	84	56	101.5	17.75	106.5	45.5	56.9	1.14

Tests Nos. 2 and 6 are figured on a basis of one hour's run, from results obtained in the last half of tests 1 and 5.

The temperature readings in these tests were taken by collecting the water as it flowed from the heater in a half-gallon measure and taking the temperature when full. The temperature of each half gallon was taken, and the temperature tabulated (of water leaving heater) is the average of all these readings. A higher reading could have been obtained if the thermometer had been attached to the outlet of the heater. At the conclusion of test No. 5, with a temperature of 60° in the bathroom, there was a temperature of 101° in the 17 gallons of water contained in a cast iron, enameled bathtub.

From the foregoing figures it will be readily seen that the cost of heating water sufficient for a bath is merely nominal at the present prevailing price of gas throughout the country.

This paper would hardly be complete without some evidence of the appreciation of the users of the water heater. The following is an extract from a letter, written to a manufacturer of instantaneous water heaters, by a New York business man whose name is familiar to everyone in this country, and it is a typical expression of the sentiment referred to in the first part of this paper:

" * * * The instantaneous heater with which you supplied me is in perfect working order. I could not ask for anything more satisfactory in every way than this heater; and, could it not be replaced, money could not buy it. It is one of the greatest conveniences that I have ever had the good fortune to use."

To be a success in every sense a heater must be well built, moderate in size for its requirements and have large heating surface. The entire heating surface must be covered with water when operating. It must be adjustable to all conditions of water and gas service. It should heat from 1 to 1½ gallons of water 50° F. with 1 cubic foot of gas. It should be pleasing in design, handsome in finish and moderate in cost, compatible with first-class material and workmanship.

Discussion.

Mr. Holmes (being called upon by the President to open the discussion) said—There is very little to add to Mr. Miller's paper, for it seems to me at least that he covers the ground very completely. I think there is nothing to argue and very little to add.

Mr. Fitzgerald—I would like to ask Mr. Miller if he has any trouble instructing his customers how to use the heaters. Is there much bother after they are installed, before the customers get in the right way of handling them?

Mr. Miller—Before the automatic valve was put in they would turn on the heat and no water and thus burn the heater up; but the automatic valve renders it impossible to turn on the gas without the water. Once in awhile they get a little puff in the heater that shakes things up a trifle, but it doesn't hurt anything. If in the heater made several years ago the gas was allowed to get in before the light was put to it the accumulation of gas would mix with the air and be retained so that it would explode; but now they are right straight up, and if the light is not put there at the proper time it is simply a straight shoot up, and no damage results. The hardest thing to explain to the consumer is this: In the hottest part of the summer time, when the water standing in the pipes is at about 70° or 80°, they start the heater and get the water from 120° to 150° with a big flow. Then, in the winter time, they turn on the water when it is down below 50°, and as they don't get hot water as quickly as they did in the summer, they think the heater is not working. I think in our city we have 200 or 300 of them in use, and in no place where the heaters are used would the consumers part with them, if they could not be replaced.

Mr. Stewart—We are trying to push the heaters in Waco. Our experience with them has been perfectly satisfactory. It is only within the last three years that the instantaneous heater business has been pushed much in Texas. The water heater is a most satisfactory arrangement, and I don't think a customer of ours who uses them would part with them under any consideration. I agree with Mr. Miller in everything he said, and I have been benefited extremely by his paper.

Mr. Holmes—I can supplement Mr. Stewart's statement by saying we have had for years a number of these heaters in use in Austin, and are again beginning to actively place them—having taken the business of their sale into our own hands. Without a single exception that I know of they are giving entire satisfaction.

Mr. Miller—The only heaters that have not given satisfaction were ones so cheaply constructed that they could be sold at a very low price. A good heater, in copper, for a bath room, will cost $30; and one under that price could not be as efficient as one would want. A nickel-plated heater will cost $35. You do not want a heater of the sort that will retail for $15 or $20.

Mr. Stewart—Does Mr. Miller sell these heaters himself, or do other local dealers handle them.

Mr. Miller—I will not keep any man from selling anything in my town that uses gas. I encourage it all I can. When I went to Dallas six years ago the plumbers in our city, who were very much out with the Gas Company, would "nail" it every time they got a chance. I have had six years' missionary work trying to get them all in good

humor with the Gas Company so as to have them help us in the gas business. Two of our plumbers and one or two of our hardware dealers are selling gas stoves.

Mr. Stewart—My limited experience with gas stoves, which covers only a few years, seems to teach me that a universal prejudice exists against gas companies among the public generally. When the Gas Company puts anything on the market it is at once concluded that it is a "robbing factor," just like the sale of gas business; and, consequently, it is very hard for the companies to make a deal on any article they sell. This necessarily forces the goods into the hands of the plumber, who, of course, being entitled to his legitimate profit on the goods, makes it a little more difficult to control the style of heater that you would like your customers to purchase. I agree with Mr. Miller that it is desirable to have the best article in the way of a heater; it is more satisfactory in general. The point in my case is I have never been able to control the sale of the goods. Of course, I don't want to take it out of the hands of the plumber; but at the same time the plumbers have a tendency to jump on us through making a larger profit out of the goods than they should.

Mr. Holmes—I would like to take issue right here with Mr. Miller. It may be (I don't think so, however), that in Austin we have a particularly "ornery" set of gasfitters and plumbers; but our experience has been that where they have done the work—they have done most of it for the last ten years, in respect of fitting and piping houses, etc.—their work has given us more subsequent bother than has accrued to us from any other part of our business. We have insisted, as far as it was within our power to insist, that they should adopt something like a reasonable size for their pipes, laying them according to some definite plan, and following some rule as to the size of the pipe and its capacity, etc.; but they won't do it. They try all sorts of makeshifts, using small pipe, crooked pipe and defective pipe of all kinds. In a few months you naturally hear there is something the matter with the gas. You investigate only to find a ⅜ or ½-inch pipe in service, where a ½ or ¾-pipe should have been used (to say nothing of a defective cock or other fitting, or a trap that should not have been placed.) So far has this dissatisfaction gone that we have found it necessary in putting in stoves to do the fitting ourselves, for the reason that we could not get the local plumbers to do the fitting in a satisfactory manner. We have thought very seriously of taking up—and I expect we will—the matter of piping the houses ourselves for the very same reason.

Mr. Miller—We do that now.

Mr. Holmes—Well, I think we will have to do it. Then, too, Mr. Stewart, we have a particularly nice lot of people in Austin; in fact, I think they are quite as good, if not a little better than those who live elsewhere. Perhaps that opinion is held by me because I reside there. However, I will say that anything the gas company recommends there "goes," without any question. If we were willing to compete with the other salesmen—the plumbers, gasfitters or stove men, and supply men who ordinarily sell the goods and carry the stock, I believe we could sell the same goods at anywhere from 10 to 25 per cent. higher than they would offer them, and do nine-tenths of the business. It may be they like the gas company and have confidence in it; I don't know about that; but I don't think we have quite the reputation that Mr. Stewart says gas companies have generally. We handled the stoves and supplies ourselves several years ago, but the plumbers and gasfitters induced our people to believe that they could do better for them. The manager of the Company at that time said: "Yes, we will turn the trade over to you." The result is that the business from year to year dropped off. Instead of selling from 40 to 100 stoves in a season the sales were far below those figures. Usually when the gas companies handle such things, 20 are sold the first year, 40 the next, 60 the next, and so on. When we turned the trade over to the gasfitters and stove men the tide went the other way—from 60 to 40, to 20 to 10. Then we took it up again ourselves and it went back the other way. We said to the gasfitters and plumbers we will afford you every facility for selling the stoves, and only ask you to carry a stove that we can recommend. They did so, but we made 20 sales where they made one. As I said awhile ago, I believe we have a better lot of people to deal with than the average gas company has, and it may be they show more confidence in us than is shown to the average gas company; but the fact is the stove men don't do a bit of business. The consumers come to us and pay us a great deal more for the same appliance.

Mr. Stewart—I am very glad to know that he is surrounded by such a genial set of people; but I think the members of the Association will agree with me, in reply to his statement that whatever the gas company says goes, that, it is the situation, or condition with all of us, it has to go.

Mr. Miller—I am inclined to think Mr. Holmes has neglected one of the best features he has. A man fits up a house, and he does it by contract; his specifications requiring that the fitting be done according to the rules and regulations of the gas company. In getting up the specifications, instead of going into the many details, the contracts simply say, "Do it according to the Gas Company." We have changed our rules and increased the size of our pipe, and when a plumber refuses to use that size of pipe we refuse to give him a certificate of inspection, and the owner of the building will not pay him for it until he does get the certificate. An inspector in our employ several years ago was a small man, and he wouldn't pass a job, so the plumber just "knocked the stuffin' out of him," but the job didn't go.

On motion a vote of thanks was passed to Mr. Miller.

[To be Continued.]

The Valuation of Spent Oxide.

The *Journal of Gas Lighting* says that Dr. Lubberger, of Carlsruhe, in an article in the *Journal für Gasbeleuchtung*, points out that spent oxide is often valued solely on the basis of the amount of prussian blue which it contains. This statement applies to spent oxide from nearly all Continental gas works, and from the numerous works in this country where purification by lime has not been adopted, or where the oxide is used in an anterior position to the lime. We therefore give some particulars from Dr. Lubberger's article.

The simplest and most general method of estimating the prussian blue in spent oxide is that devised by Drehschmidt. It is described by him in the fourth edition (German) of Muspratt's "Chemie," Vol. V., p. 505. Ten grammes of the oxide are put in a 500 c.c. flask, along with 150 c.c. of water and 1 gramme of ammonium sulphate. Fifteen grammes of mercuric oxide are then added, and the whole is boiled for a quarter of an hour. After cooling, it is agitated while 0.5 to 1.0 c.c. of a saturated solution of mercurous nitrate, and so much ammonia as causes any precipitate, are added. Then the flask is filled to the mark with water, and a further 8 c.c. are added to compensate for the volume of the solids. It is afterwards agitated, and filtered through a dry filter. Then 200 c.c. of the filtrate, representing 4 grammes of the oxide, is transferred to a 400 c.c. flask; and at least 6 c.c. of ammonia (.91 sp. gr.) and 7 grammes of zinc dust are added, for the purpose of separating the mercury from the mercury cyanide, and converting the cyanogen into ammonium cyanide. After agitation for some minutes, 2 c.c. of 30 per cent. solution of potash are added, to prevent volatilization of hydrocyanic acid; and the whole is made up to 400 c.c., and filtered through a dry filter. Then 100 c.c. of the filtrate, representing 1 gramme of the oxide, is mixed in a 400 c.c. flask with excess—30 to 35 c.c. generally suffice—of decinormal solution of silver; then agitated; and acidified by means of dilute nitric acid. The cyanogen is thus separated as silver cyanide; and after the precipitate has settled out, the flask is filled up to the mark, agitated, and the contents filtered through a dry filter. Then 200 c.c. of filtrate is taken for the determination of the excess of silver used, by titration with $\frac{1}{10}$ normal solution of ammonium sulphocyanide, according to Volhard's process.

It has often been questioned whether the sulphocyanide and chloride are wholly removed by the mercurous nitrate and ammonia precipitation. Burschell has therefore adopted the plan of extracting the blue from the oxide in the first instance, by means of alkali and iron salts; and only estimating by Drehschmidt's method the blue thus purified. But Drehschmidt has shown that the sulphocyanide and chloride are wholly removed if a sufficient quantity of the mercurous nitrate is added, and that then only the cyanogen is estimated in the titration. In the great divergence in the composition of spent oxides, it has, however, been observed that a portion of the cyanogen can exist in them in combinations which do not permit of the production of ferrocyanide by the usual manufacturing processes. This portion of the cyanogen is therefore valueless for the manufacture of blue or other ferrocyanides. Drehschmidt has, indeed, shown that the whole of the cyanogen in the spent oxide from the Berlin gas works can be converted to potassium ferrocyanide; but it has not been proved whether or not such is the case generally.

A number of samples from the Carlsruhe gas works were therefore examined according to Drehschmidt's method, and to Burschell's modification of that method. As much sulphocyanide was present in some cases, the effect of using 10 c.c. in place of 1 c.c. of solution of mercurous nitrate was tried; as was also that of extracting most of the sulphocyanide from the samples with hot water, and otherwise proceeding according to Drehschmidt's method. The following results are selected from those given in the paper:

No. of Oxide Sample.	Percentages of Prussian Blue according to—Drehschmidt's Method.	Burschell's Modification.	Drehschmidt's Varied by the Use of 10 c.c. of Mercurous Nitrate.	Dreschmidt's after Preliminary Extraction of Sulphocyanides with Hot Water.	Percentage of Sulphocyanide, as the Ammonium Salt.
III..	11.12	7.90	10.11	....	2.00
V.	8.60	6.96	....	7.82	1.75
VI.	9.50	7.39	....	8.90	1.75
VII.	9.11	7.16	....	8.80	1.98

It seemed very improbable that so much of impurities could be present in the silver precipitate as the differences in these numbers indicated; and as qualitative tests of the precipitate confirmed this view, quantitative tests were carried out. Drehschmidt's method was pursued until after the point where zinc dust is added; then measured quantities of the solution which has been treated with zinc dust were mixed with excess of silver nitrate, and acidified with dilute nitric acid. The precipitate was next dried at 105° C., and collected on a weighed filter; and the weight when constant was noted. This is the weight of silver cyanide plus impurities. After incineration of the filter apart from the precipitate, the latter was raised to incandescence, first in air, and afterwards in a stream of hydrogen, until the weight was constant. The weight of silver thus found afforded by calculation the weight of silver cyanide equivalent to it; and from the difference between this weight and that of the silver cyanide plus impurities, the amount of silver sulphocyanide in the impurities was found from the ratio between the molecular weights of silver cyanide and silver sulphocyanide. The qualitative tests had established the absence of chloride in the precipitate.

In one volumetric determination by Drehschmidt's method, 19.7 c.c. of decinormal solution of silver were used per gramme of oxide. Now 1 c.c. of this solution corresponds to 0.4771 per cent. of blue; therefore the oxide would contain according to this test $19.7 \times 0.4771 = 9.39$ per cent. of blue. Presuming 18 c.c. of the solution were precipitated by ammonium cyanide, and the remaining 1.7 c.c. by ammonium sulpho cyanide, then, because 1 c.c. of decinormal silver solution is equivalent to either 13.4 milligrammes of silver cyanide or 16.6 milligrammes of silver sulphocyanide, the precipitate from 1 gramme of the oxide would consist of 0.2412 gramme of silver cyanide and 0.0282 gramme of silver sulphocyanide, and would weigh $0.2412 + 0.0282 = 0.2694$ grammes. If the whole of this precipitate were regarded as silver cyanide, 20.1 c.c. of decinormal solution of silver would have been needed; and this would have been equivalent to 9.59 per cent. of blue in the oxide, which is a higher result than that afforded by the volumetric Drehschmidt test. A higher result than that obtained by the volumetric test is obtained whenever appreciable quantities of sulphocyanide are present. In tests on four samples of oxide, the results were in every case lower than those obtained volumetrically, therefore the precipitates could have contained only trifling amounts of sulphocyanide. The following are the figures obtained by these and other methods from the four samples:

Sample Number.	Percentage of Prussian Blue in the Oxide. III.	IV.	V.	VII.
By Drehschmidt's volumetric method	10.50	9.39	8.60	8.80
Calculation from the total weight of the precipitate, which is regarded as wholly silver cyanide.....	10.30	9.34	8.58	8.74
Calculation from the weight of silver cyanide as calculated from the silver obtained.....	10.30	9.04	8.08	8.51
By Burchell's modification.....	7.90	6.58	6.91	7.13

These figures demonstrate that the solutions which have been treated with the zinc dust contain in all cases more hydrogen cyanide than could be formed from the Prussian blue present. They show that there exist in spent oxide, in addition to the ferrocyanides, other cyanogen compounds which do not yield Prussian blue and are not precipitated by iron salts. These compounds, however, yield mercury cyanide when boiled with mercuric oxide; and they are consequently estimated as Prussian blue in Drehschmidt's method. But the spent oxide is only worked up to ferrocyanides; and therefore the other cyanogen compounds are of no value to the chemical works. Drehschmidt's method, without preliminary extraction of the blue according to Burschell's plan, can therefore only be used for the valuation of spent oxide when it is certain that all cyanogen compounds, except ferrocyanides, are absent. In conjunction with Burschell's modification, it undoubtedly is the most reliable and exact method of valuation yet devised.

Preliminary Report of the Committee on Coal Analysis.[1]

To the President and Members of the American Chemical Society:

At the Cleveland meeting of the American Chemical Society a Committee, consisting of W. F. Hillebrand, C. B. Dudley and W. A. Noyes, was appointed to consider the methods of proximate analysis of coal with a view to the adoption, if possible, of uniform methods for this country. After discussion among themselves, the Committee have formulated the following outline of methods for analysis which they herewith submit, rather as a means of securing further information than as a final report. The Committee very earnestly request all chemists interested in the matter, who may see this report, to send to the chairman of the Committee a criticism of the methods proposed and a statement of any objections they see, and of any modifications which they think desirable.

Since the literature of the subject is widely scattered and much of it is not easily accessible, the Committee request that all who have published papers bearing on the subject will, if possible, send to the Committee reprints of such papers; or, if that cannot be done, a statement of where such papers can be found and the points covered.

Without the full and hearty co-operation of others the labors of the Committee will be greatly increased and the conclusions finally arrived at will be less representative of general experience than it is desired they should be.

Methods of Analysis.

1. *Sampling.*—At least 5 pounds of coal should be taken for the original sample, with care to secure pieces that represent the average. These should be broken up and quartered down to obtain the smaller sample which is to be reduced to a fine powder for analysis. The quartering and grinding should be carried out as rapidly as possible, and immediately after the original sample is taken, to prevent gain or loss of moisture. The powdered coal should be kept in a tightly stoppered tube or bottle till analyzed.

2. *Moisture.*—Dry 1 gram of the coal in an open porcelain or platinum crucible at 104° to 107° for one hour, best in a double-walled bath containing pure toluene. Cool in a desiccator and weigh covered.

Question: Has anyone experience with other methods of drying? Over sulphuric acid, *in vacuo*, in a current of air, in watch glasses, or otherwise? Especially in this and other cases, the Committee desire any comparative results which can be furnished.

The following comparison of the effect of drying one hour in a toluene bath, 20 hours *in vacuo* over sulphuric acid, and in air over sulphuric acid was made by Dr. Hillebrand:

	One Hour in Toluene Bath.	20 Hours *in vacuo* over H_2SO_4.	In Air over H_2SO_4. 2 Hrs.	48 Hrs.	120 Hrs.
Coal No. 1..	2.85	3.60	2.87	3.15	3.39
" ..	3.10	3.59	....	....	....
" ..	3.23	3.57	....	....	....
" ..	3.25	3.49	....	....	....
" ..	3.24	....	....	....	....
" ..	3.22	....	....	....	....
" ..	3.27	....	....	....	....
" 2..	1.84	2.08	1.77	....	2.00
" ..	1.83	2.07	....	....	....
" 3..	1.52	1.75	1.42	....	1.70
" ..	1.51	1.73	....	....	....
" 4..	1.01	1.04	1.05	....	1.18
" ..	1.08	1.03	....	....	....
" 5..	1.40	1.69	1.45	....	1.66
" ..	1.41	1.67	....	....	....
" ..	....	1.67	....	....	....
" 6..	0.30	0.21	0.23	....	0.25
" ..	0.34	0.28	....	....	....

These results seem to indicate that drying *in vacuo* gives higher, and, probably, more correct results than drying at 105° for one hour.

The following experiments were carried out by Mr. W. E. Burk at the Rose Polytechnic Institute[2] for the purpose of determining whether volatile matter other than water is lost in drying bituminous coals. A hard glass tube was partly filled with copper oxide, partly jacketed with a glass sleeve so that a portion could be heated to 100° by a current of steam. The coal was weighed in an aluminum boat enclosed in a weighing tube, and was then heated to 100° for an hour in a current of dry air. The moisture and any volatile matters which were expelled were passed over the heated copper oxide and the water and

1. From the *Journal* of the Society.
2. See Proceedings of the Indiana Academy of Sciences for 1896, p. 113.

carbon dioxide were absorbed as usual in calcium chloride and in potash bulbs. There results were as follows:

Weight of Coal Taken.	Loss in Weight of Coal at 100 Degrees.	Water Found in Calcium Chloride Tube.	Per Cent. of Water in Coal.	Per Cent. of Carbon Found in Potash Bulb.	Per Cent. of Excess of Hydrogen Found.
1.4217	0.1994	0.2014	14 00	0.048	0.016
1.1195	0.1596	0.1625	14.25	0 058	0.029
3.1079	0.2111	0.2113	6.78	0.022	0.001
3.2356	0.2152	0.2142	6.65	0.025	.....
2.9408	0.1967	0.1967	6.65	0.037	.....

The amount of moisture found was slightly higher than was found in the same coal by the usual method, perhaps because of the current of dry air over the coal. Since the loss of volatile matter other than water was always less than one-tenth per cent., it can safely be disregarded for most practical purposes, with coals of this class.

3. *Volatile Combustible Matter.*—Place one gram of fresh undried coal in a platinum crucible, weighing 20 to 30 grams and having a tightly fitting cover. Heat over the full flame of a Bunsen burner for 7 minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cm. above the top of the burner. The flame used should be 20 to 25 cm. high when burning free, and the determination made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon. To find "volatile combustible matter," subtract the per cent. of moisture from the loss found here.

Questions: Should a larger portion be taken? Should the coal be heated more gradually at first? Should a blast be used? Can results be obtained by heating in a muffle, or in any other manner, which will agree with those obtained by this method?

The Committee consider the determination as largely arbitrary, in any case, and believe that uniform results in the hands of different chemists will be best secured by making the conditions as simple as possible. The most serious objection to the method proposed appears to be the danger of mechanical loss at the commencement of the heating. It is believed, however, that the error from this source is less than would arise from any method which leaves the application of the heat to the judgment of the operator.

The Committee especially desire to secure any analytical data which may be available to show the degree of concordance of results obtained by the same or different chemists. Also any comparison of analytical results with results of commercial coking.

4. *Ash.*—Burn the portion of coal used for the determination of moisture, at first over a very low flame, with the crucible open and inclined, till free from carbon. If properly treated, this sample can be burned much more quickly than the dense carbon left from the determination of volatile matter.

Question: Are carbonates likely to be present in the ash in such amount that heating over a blast would lessen the weight appreciably?

When the sulphur in the coal is in the form of pyrites, that compound is converted almost entirely into ferric oxide in the determination of the ash and, since 3 atoms of oxygen replace 4 atoms of sulphur, the weight of the ash is less than the weight of the mineral matter in the coal by five eighths of the weight of the sulphur. While the error from this source is sometimes considerable, the Committee are now prepared to recommend such a correction.

5. *Fixed Carbon.*—This is found by subtracting the per cent. of ash from the per cent. of coke as found in paragraph 3.

6. *Sulphur.*—What methods are used? Eschka's, with sodium or potassium carbonate, fusion with sodium carbonate and potassium nitrate, Carius' or others? Any comparative results are especially desired.

7. The Committee would recommend that the heating effect be calculated on the basis of the coal burned to carbon dioxide and vapor of water at 100° C., and be stated either in calories per kilogram or English heat units per pound. The theoretical evaporative effect is to be calculated by dividing the number of calories per kilogram by 536 or the number of English heat units per pound by 965. In either case it expresses the theoretical number of kilograms or pounds of water converted into steam from and at 100° C. by one kilogram or pound of the coal.

A calculation of the results of 21 analyses, with determinations of heating effect with the bomb calorimeter, made with Indiana and Pittsburgh bituminous coals, shows that the heating effect may be found in all cases examined, with a maximum error of 2 per cent., by the following rule:

Subtract from 100 the per cents. of moisture and ash and one-half the per cent. of sulphur, and multiply the remainder by 80.7. The product will be the heating effect of the coal burned to vapor of water, expressed in calories.

The Committee will be glad of any data which will enable them to further test this factor and also of any data with regard to other methods of determining heating effect.

Persons interested in the subject of coal analysis are requested to send any communications which they may wish to make, to Prof. W. A. Noyes, Rose Polytechnic Institute, Terre Haute, Ind.

W. A. Noyes,
C. B. Dudley,
W. F. Hillebrand, } Committee.

Station Photometry.

[By Buckner Speed, in *Electrical World.*]

The following explicit and detailed directions for the construction and operation of a central station photometer department may be of value to electric lighting engineers who wish to take more care as to the lamps they are using, but do not know just how to go at it:

There should be at the station in the testing room a photometer in the form of a closed wooden box, 8 feet long by 16 inches square, painted dull black inside and out. This photometer box should be provided with baffle diaphragms as described below.

At one end of this box should be placed a standardized 16-candle power lamp, at the other end the lamp to be tested, and between these lamps a photometer rail carrying the screen carriage. The screen should be an ordinary reversing Bunsen spot, viewed on both sides simultaneously by means of inclined mirrors.

Carried by the screen carriage there should be a hood, looking into the mirrors, and also projecting through the face of the photometer box and carrying a sliding cover which, moving with the hood, should cover the slot in the front of the box through which the throat of the hood slides.

By this means the observation of the spot and the reading of the bar may be accomplished without admitting light to the box.

The sliding screen carriage, hood and sliding cover should be rigidly connected, and attached also to a pointer traversing a scale fixed on the front of the photometer box.

Standard Lamps.—Greater confidence can be placed in the results obtained by the use of lamps standardized with care on a plain candle bar photometer, than by the use of so-called standard lamps purchased on the market.

Buy three packages of 1 dozen English standard sperm candles from three supply houses in different cities and number and label each candle, also enter in record book the number and maker or furnisher of each dozen candles. Select from each package the best six average candles, choosing well centered wicks (at both ends) and rejecting those which caliper furthest from the mean in diameter; also caliper size of wick, note and record color of sperm and reject those which are not the same color as the others in the same package.

Light these selected 18 candles in a still room and let them burn until the cups have reached the full diameter of the candle. Blow them out and empty the cups of melted sperm formed around the wicks. Trim the rims of the cups flat to the wick, trim the wicks square off, leaving them one-half inch long from the flattened cups. Light the candles again and let them burn down about one-half inch of sperm, then select the best three out of each original lot, judging by medium height of flame and good behavior of wicks, etc. This will give nine representative candles; the mean of the light of the nine is to be taken as the true candle power. They are the primary standards.

These nine candles are to be burned one by one on a regular or improvised bar photometer, the candles being mounted on a weighing balance to correct for rate of burning by grains of sperm consumed per minute. The candles are not to be burned to butts shorter than 1¼ inches in length.

To insure concordant results in the burning, trim the cup flat, trim the wick half an inch long, turn the flat side of the wick perpendicular to the bar, light the candle and let it burn until flame is 1¼ inches high, bring the weighing balance beam to zero and start the stop watch when the pointer of the balance crosses the zero line. Take off 10 grains weight at once and catch the first photometer reading at the first 30 seconds and on each half (not even) minute reading thereafter. This will get in five readings one minute apart and leave about half a minute for the catching of the sperm weight at the end of the five minutes. When the balance pointer again crosses zero, stop the stop watch and record the time of the burning of the 10 grains.

If the room is large and perfectly dark and the walls black and all white substances guarded against reflecting light toward the screen, the candle power of an incandescent lamp at the other end of the photometer bar can be determined with reasonable accuracy.

Nine standard candles have been selected for the primary standard, as detailed above, from them by direct comparison are to be made the secondary or working standard incandescent lamps for use in the station photometer.

From a barrel of 250 high grade lamps carefully chose 25 lamps, avoiding any handling of the glass, and manipulating them by the brass bases only. These 25 lamps must conform to the following requirements:

1. Efficiency not higher than 3.6 watts per candle power (take the maker's word as to this.)
2. Lamps to have Edison screw bases with porcelain filling, bulbs to be of uniform size and shape and of good workmanship.
3. Filament to set true and central in bulb and to lie in a flat plane when cold, forming a single unanchored U.
4. Filaments to remain flat and plane when current is turned on and not to curl or twist any when lighted and turned out.

In handling the lamps in the socket for this trial use the tissue paper in which they are packed and do not touch the glass.

Examine these 25 again, noting:

1. Faulty or protruding leading in wires or loose bases.
2. Striations in the glass.
3. Kinks in the filament or bright spots in the filament when lighted.
4. Lack of uniformity in the size and position of the filaments in the globes.
5. Undue fluorescence of globes when the current is on.

Probably 20 will stand this inspection. Measure each one of these on the station photometer, comparing them with an old lamp which has burned at least 200 hours and which in general complies with the conditions just noted. Mark and record the candle power of each of the new lamps in terms of the old one which is a temporary selecting standard. Compute the mean of the new lamps in terms of the old lamp and reject any lamps that are very far from the mean value. Number each lamp that passes this test with a lead pencil on the porcelain base and record its value in percentage terms of the old lamp, in a record book.

Put all these lamps (from 18 to 20) in a bank of receptacles very heavily wired to prevent drop, and let them burn 100 hours on the station current. After the lamps have been burned 100 hours compare them again with the temporary selecting standard lamp (the old lamp) which has been carefully laid away in the mean time and neither used nor handled. Measure and record the values of the lamps now after their 100 hours of burning, in percentage terms of the old lamp. In this test, include an ammeter in the circuit of the new lamp and also measure the voltage and hold it at the rated voltage of the lamp.

Select the 9 lamps from the above lot which are nearest the mean in candle power in terms of the old lamp, rejecting those which have changed most in the 100 hours, also any which have current consumptions far from the mean current of the lot. Make a mark on the globe near the base ferrule, so that the same face of the filament will always be turned toward the photometer screen. Provide separate stout pasteboard boxes for each lamp, the boxes to have hinged tops and to be provided with cotton batting lining and padding. In the top of each box put a copy of the full record of the lamp as taken from the record book.

These nine lamps are now ready for standardizing. They are at their most stable period of life, having in the 100-hour burning flashed off all their initial irregularities, and from the above tests and examinations have proved themselves to be the best of good hardy lamps. When their mean value, determined from the nine primary standard candles is known, then they become the secondary or working standards. Test these nine lamps one by one with a regular standard candle bar photometer, using the nine primary standard candles one by one.

The lamps are to be marked on the porcelain bases in India ink, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Similarly mark the candles A, B, C, D, E, F, G, H, I.

Using candle A, measure lamp No. 1 with it for five minutes, thereby obtaining five settings of the screen. Average these and correct by the consumption of sperm.

As soon as the 5-minute test on lamp No. 1 is made blow out the candle, trim it and get ready for the test of lamp No. 2 on candle A, and in each case let each 5-minute burning be a separate test.

On candle A test lamps Nos. 1, 2, 3, 4.
On candle B test lamps Nos. 2, 3, 4, 5.
On candle C test lamps Nos. 3, 4, 5, 6.
On candle D test lamps Nos. 4, 5, 6, 7.
On candle E test lamps Nos. 5, 6, 7, 8.
On candle F test lamps Nos. 6, 7, 8, 9.
On candle G test lamps Nos. 7, 8, 9, 1.
On candle H test lamps Nos. 8, 9, 1, 2.
On candle I test lamps Nos. 9, 1, 2, 3.

The exact details of this test should be as follows:

Carefully take lamp No. 1 out of its box without touching the glass and screw it into the adjustable socket in the standard photometer. Turn the marked face toward the photometer screen, set the plane of the filament exactly perpendicular to the axis of the photometer bar and concentric with it, let the axis passing through the center of the screen (parallel to the axis of the bar) pass through the loop of the filament so that the distance from this axis line to the top turn of the filament is equal to one-third of the height of the filament.

Hold the voltage delivered to the lamp steadily at the voltage marked on the lamp, using a small rheostat for the purpose. Let one observer work the rheostat, record voltage, current and watts, while the other is making the settings.

The first mentioned observer should manage the candles, stop watch, meters and rheostat so that the screen observer need not use his eyes for anything but his own observations. As soon as lamp No. 1 is finished and recorded put it back in its box. Blow out the candle, trim the cup flat and the wick to one-half inch and start again on lamp No 2 when the flame has come to length.

It will be seen that the comparison of the nine secondary standard lamps with the nine primary standard candles, with four five-minute sets of observation on each candle, each of the observations consisting of five screen settings, involves 180 settings of the photometer screen. By steady work this can be done in two days without unduly long hours in the photometer room.

To compare these values and get the most probably correct value of the nine secondary standard lamps a simple graphic method will be found the most practicable.

On thin tracing paper lay off and plot a separate diagram for each candle as follows: Draw a base line and four equidistant perpendicular lines and on these to a convenient scale lay off the candle powers of lamps 1, 2, 3, 4, as obtained from candle A; mark this diagram "A." In like manner make diagram "B" show the values of lamps 2, 3, 4, 5, and so on, making in all nine diagrams. Next superpose the corresponding numbers on each sheet over each other as nearly as the three points will fit, keeping the perpendiculars always parallel to each other, and draw a new mean base line through the average of all the base lines of the diagrams. In this way the most probable true value of the lamps will be obtained in terms of the mean of all the candles.

It might be of interest and also serve as a check on the readings to plot the values as corrected on a new curve having nine ordinates, each candle power, as corrected by the above graphic method being laid off. Also plot the comparative values which these lamps gave when they were balanced again by the temporary selecting standard lamp, referred to above as the "old lamp." This is not, however, necessary.

Having now secured nine lamps of more than average excellence and with reliably known candle powers, make copies of the records of each lamp and paste them in the insides of the individual lamp boxes. Three of these lamps should be filed away for reference and not used unless some dispute comes up as to the candle power standard in use by the station at that date. For instance, if the maker of a lot of rejected barrels of lamps disputes the standard these lamps will be a readily reproducible candle power standard. The remaining six lamps are to be each used 50 hours of actual testing only.

Station Testing.—Take the case of a consignment of 50 barrels of lamps warranted by the maker to deliver a specified candle power for a given number of hours of burning, with a variation of voltage not to exceed a specified percentage above that marked on the lamps.

Two lamps should be taken at random from each barrel. A box with compartments, like an egg-shipping box, is to be provided and each pair of lamps put in a separate compartment with a card bearing the number of their barrel. These 100 lamps are then to be measured on the station photometer and in the record book are to be placed the serial numbers of the barrels, etc., the candle power of each pair of lamps and the current and watt consumption. With the station photometer all this can be done in two hours at the outside and has been done in much less time.

There should also be provided a heavily wired bank of receptacles laid off to correspond to the compartment box mentioned above, and each of the lamps should be put into its receptacle and burned continu-

ously. This bank of receptacles may be located in the dynamo room, where the attendants can check the voltage at frequent intervals. A rheostat and a recording voltmeter (checked once a week with a standard instrument) should be connected to this bank of receptacles, so that a record of the voltage at which the lamps were burned can be obtained.

On a regular day each week the current should be switched off, and all the lamps run through the station photometer, and this repeated until they are burned out or the contract for life and candle power has been fulfilled. About five weeks will be the duration of the burning.

A full statement may then be made showing the average candle power, maximum and minimum candle power, and current and watts (total and per candle power) of the lamps from each barrel.

There may accompany this report the diagrams of the voltage from the recording meter, which will also show the duration of the burning and the duration of the intervals during the weekly tests.

No lamps should be used from the barrels under trial until they have been tested fully and the report approved by the buyer of the lamps.

If the average of two lamps is below the required values or if either of them is very much below, then there may be taken from the doubtful barrel another sample of three lamps and the decision upon the barrel may be withheld until they are fully tested. Then if the barrel still falls below the requirements it should be returned to the maker.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Green Bay (Wis.) Gas and Electric Light Company is to be reorganized, Mr. Sinclair Mainland (who has been the active man in the Company for some time past) and his brother (Mr. William Mainland, of the Oshkosh Company) having secured by purchase a majority of the stock.

THE new holder for the Faribault (Minn.) Consolidated Gas and Electric Company is to have a capacity of 200,000 cubic feet.

AT the annual meeting of the Knoxville (Tenn.) Gas Light Company the following officers were elected: Directors, R. R. Swepson, W. P. Washburn, L. H. Spilman, E. H. Saunders, John Y. Johnson, A. D. Leach and J. E. Hood; President, R. R. Swepson; Vice-President, A. D. Leach; Secretary and Treasurer, E. H. Saunders.

"A. M. T.," is informed that the new rates scheduled by the Charleston (S. C.) Gas Light Company—$1.60 per 1,000 for an illuminating supply, and $1.30 per 1,000 for fuel account—take effect May 1st. The Company also agres to furnish and connect gas stoves at net cost to itself.

THE officers chosen by the Cohoes (N. Y.) Gas Light Company are: President, William E. Thorne; Secretary, D. H. Van Auken; Treasurer, William E. Thorne.

THE following contracts are amongst the many on the books of Messrs. Bartlett, Hayward & Co.: A 1,500,000 cubic foot holder in steel tank for the U. G. I. Company, at its Point Breeze station, Philadelphia; a 1,000,000 cubic foot holder for the U. G. I. Company, at the Market street station, Philadelphia; an 800,000 cubic foot holder in steel tank for the Peoples Gas Improvement Company, Trenton, N. J., and a 150,000 cubic foot holder and tank for same Company; a 500,000 cubic foot holder and tank for the Brooklyn Union Gas Company; and a 200,000 cubic foot holder and tank for the Brooklyn Borough Gas Company.

AT the annual meeting of the Plainfield (N. J.) Gas and Electric Light Company, the following Directors were elected: Henry G. Runkle, A. J. Bronson, William Runkle, F. A. Pope and E. G. Pope.

"OBSERVER," writing under date of the 12th inst. says: "Matters pertaining to the Boston gas situation have remained quiet during the past month. It seems evident that the demands of the Lawson faction have been complied with, for nothing has been heard from that quarter for some time; and notwithstanding Mr. Lawson's statement in his advertisement of Feb. 18th that 'I intend to follow this matter to a conclusion,' it is generally accepted as a fact that his intention has gone to pave another portion of those streets to which he has so vividly referred. His intimate knowledge of how various gas and other deals have been worked enable him in his publications to throw a flood of light upon the methods, which was very illuminative to the gentlemen at the State House, and to the public at large. For what he did in this direction he has the thanks of honest gas investors. The report of the Board of Gas and Electric Light Commissioners, having been referred to the Committee on Manufactures, came up before that body on April 2. Chairman Barker, of the Commission, presented three bills, the principal points of which are given in the following sections:

"'*First Bill.*—All persons and associations or combination of persons engaged directly or indirectly in the manufacture, sale or distribution of gas or electricity used or designed to be used for public consumption or sale for heat or light in this Commonwealth, or used or designed to be used for sale to any gas or electric light company in this Commonwealth, shall hereafter issue or negotiate stock, bonds, coupon notes, certificates of indebtedness or ownership, or of proportionate ownership in any such business, or the property thereof, only for such purposes as may be authorized by vote of said persons, and approved by the Board of Gas and Electric Light Commissioners, and only such amounts of stocks, bonds, coupon notes, certificates of indebtedness or of ownership or proportionate ownership in any such business, or the property thereof, as may from time to time, upon investigation by the Board of Gas and Electric Light Commissioners, be deemed and be voted by them to be reasonably requisite, for the purposes approved as aforesaid, and for which such issue of stock, bonds, notes or certificates, has been authorized?'

"'*Second Bill.*—If any person, association or combination of persons owning or controlling a majority of the capital stock of a gas or electric light corporation, shall hereafter issue or negotiate any stock, bonds or coupon notes or certificates of ownership or proportionate ownership or other evidence of indebtedness based upon or secured by the property, franchise, stock or business of such corporation, unless such issue is especially authorized by a statute of this Commonwealth, the supreme judicial court sitting in equity may, in its discretion, dissolve such domestic corporation.'

"'*Third Bill.*—No contract between any person, association or corporation engaged in the manufacture, sale or distribution of gas or electric light, and any other person, association or corporation engaged in the manufacture, sale, or distribution of gas or electric light buys or sells or distributes, or assumes or agrees to buy, sell or distribute any gas or electricity, made or furnished by, or distributed through the pipes or wires of any other person, association or corporation engaged in any such business, and no contract whereby any such person, association or corporation, pays or agrees to pay any money, or delivers or gives or agrees to deliver or give anything of value to, or for the benefit of, any other such person, association or corporation, or his or its shareholders or other creditors, shall be valid or binding until the terms thereof shall have been approved by the Board of Gas and Electric Light Commissioners, after such hearing as said Board may deem advisable.'

"These bills were evidently suggested by the recent evasion of the laws by the New England Gas and Coke Company, and designed to prevent a repetition of the same scheme. All the legal talent of the Coke Company were present at the hearing and objected strenuously to the bills on the grounds that they were too far reaching, and that, as the Company was primarily a coke company, with gas, tar and ammonia as residual products, it should not be subjected to the usual gas legislation. Inasmuch as all its advertisements attempt to enlist the sympathy of the public, by means of 'scare heads' relating to cheap gas, it seems as if at times the lawyers hardly knew on what ground to stand. The hearing finally ran into technical matters, in an attempt to show good reasons for the existence of the Coke Company, beginning with a three-column letter from Mr. Whitney, published as an advertisement in all the Boston papers next day. Mr. Whitney appears to be thoroughly impressed with the dangers of distributing water gas, for he devotes nearly one-half his article to this point. He states its cost in the Bay State works, from 1892 to 1897, to have been from 30 to 35 cents in the holder. When water gas was first made in Boston it was costing the companies, so he says, 57 to 60 cents to put it in the holder; and he estimates that at the present time it would cost from 45 to 50 cents. From these statements he infers there can be no substantial reduction in price in Boston; nor can what he denominates a healthy gas be distributed until he is allowed to go on with his process. Then, having access to the double lines of pipes now existing in Boston, a healthy illuminating and a fuel gas will be distributed, at prices far below the present. In place of the worthless coke now made in coal gas works a coke will be manufactured, the value of which is certified by the New York, New Haven and Hartford Railroad to be equal to *Cumberland* coal. Its use will revive anew the foundries of the old Bay State; locomotives will be run without smoke; electric lights will be produced by gas engines run by fuel gas at almost nominal cost; power will, by the same means, be reduced to a very low cost; by means of the am-

monia produced the rocks and hills of New England will blossom with tropical luxuriance, while the brilliant colors of the spectrum, held latent in the tar, will be extracted for the decoration of all mankind. At the following hearing experts explained various technical details, regarding heat units, etc., which the Committee could hardly be expected to understand, and with which the experts were not at home, if the various newspaper reports can be relied upon. Other hearings are to follow, and a possible visit to Glassport, Pa., is contemplated, to inspect the coke oven plant at that point."

THE authorities of Painesville, O., have arranged an ordinance under which the Painesville Gas and Coal Company is to operate for the ensuing five years. Under the terms of the agreement the Company is to furnish gas to its ordinary consumers at these rates: For an illuminating use, $1.25 per 1,000 cubic feet; for fuel and power use, $1 per 1,000; to the village, for use on public account, and for any purpose, $1 per 1,000. Section 3 of the ordinance, which relates to the testing of meters, is as follows: "All meters now in use or hereafter adopted by said Company shall be tested at the request of the consumer, in his presence if desired, by an agent of the Company, with a meter prover, the holder of which shall contain not less than 5 cubic feet and which has been tested, stamped and sealed by the State sealer of weights and measures. If the meter be found correct the party requesting the inspection shall pay a fee of 25 cents and the expense of removing the same for the purpose of being tested, not to exceed in all the sum of $1.25; but, if proved incorrect, no charge shall be made therefor, and said Company shall be required to at once furnish a new and correct meter to such consumer without charge. All governors, meters and appliances of said Company shall at all times be subject to the inspection of the proper officer, to be designated by the Council, for the purpose of determining the quality and pressure of gas furnished, the correctness of meters, and whether or not the terms and conditions of this ordinance are being complied with on the part of said Company."

UNCONFIRMED advices are to the effect that, at the recent annual meeting of the Decatur (Ills.) Gas Light and Coke Company, it was determined to dispose of the property to Messrs. A. G. and G. C. Danforth, of Peoria, Ills., at their bid of $130,000. We understand that the succeeding corporation will be known as the Decatur Gas Light and Electric Company, and that the plant will be virtually rebuilt.

AT the annual meeting of the Mount Holly (N. J.) Gas Company the officers chosen were: Directors, W. Budd Deacon, William J. Irick, John Semple, H. C. Risdon and Henry J. Irick; President, W. Budd Deacon; Secretary and Treasurer, Henry C. Risdon.

THE Pottstown (Pa.) City Council has granted a franchise to the projectors of the Citizens Gas Company, who propose to operate in opposition to the Pottstown Gas Company.

Some Extracts from the Annual Report of the Gas Department, City of Cassel, Germany.

These extracts are from the annual report of the gas department of the city of Cassel, as published in a recent number of the *Journal für Gasbeleuchtung:*

The new works, to which the statistics refer, were started entirely with "inclined" retorts, December 20th, 1894.

There were originally 10 benches of "inclines," with 9 retorts per bench; the retorts being only 11 feet 6 inches long on the slope. Two more of the same kind of settings have been added since the starting of the works, so that now there are 12 benches with a total of 108 retorts, all set on the Coze plan.

With retorts of only the length of those mentioned, the best results cannot be expected; since experience has shown that retorts 15 ft. 9 ins., 18 ft. and 20 ft. long, are operated without the slightest difficulty, and with a very great increase in economy of operation. For example: Mr. Edward Drory, at his Gitschiner strasse works, Berlin, finds no difficulty in carbonizing about double the weight of coal per 24 hours, which is reported in the following lines as done at Cassel.

The report states that during the year 158,409,422 cubic feet of gas was made, using 34,842,416 lbs. of coal; the yield per pound of coal was, therefore, 4.56 cubic feet. The retorts were charged 5 times in each 24 hours, or once every 4 hours and 48 minutes; the weight of coal being 426 lbs. per charge per retort; make per bench, in 24 hours, 87,346.17 cubic feet; 3.5 per cent. of the retorts in action were required for "scurfing;" 18.8 per cent. of the coke made was used in the furnaces; or, it may be stated this way, 13.4 per cent. by weight of the coal carbonized was required for heating the benches; 70 per cent. of the coal carbonized was returned as coke; 4.1 per cent. tar; and the balance, gas and ammoniacal liquor.

Analysis of the gas give the following figures:

Hydrogen	51.9 per cent.
Methane	31.11 "
Heavy hydrocarbons	4.0 "
Carbon monoxide	7.1 "
Carbon dioxide	2.5 "
Oxygen	0.1 "
Nitrogen (by difference)	3.0 "
	100.0

The furnace used with the bench is of the regenerator type of simple construction, and the heat in the oven was quite uniform, as the report of tests (made by means of the Keiser & Schmidt thermo element) indicated, viz.:

Bench No.	Ten-p. at Lower End of Retort in Degrees F. in Furnace.	Temp. at Upper End of Retort in Degrees F. in Furnace.	Difference at Upper End.
I.	1,886	1,927	+ 41
II.	1,941	1,981	+ 40
IV.	1,958	1,940	— 18
V.	1,922	1,907	— 15
VIII.	1,916	1,961	+ 45
IX.	2,094	2,088	— 6
X.	2,138	2,116	— 22
XI.	2,039	2,031	— 8

The engineer and superintendent of the Corporation gives the names of 12 cities where inclined retorts on the same plan as at Cassel have been introduced since his works were erected; and where, at date of report, several thousands of such retorts are in daily and constant use.

Concerning repairs to the charging and discharging apparatus he states that he cannot give figures because to date he has had no occasion to make repairs to either; pretty good for a system in operation for over three years at date of writing.

The corporation have invested some capital in what looks as if it were a very sensible move and worth considering on this side of the Atlantic, viz.:

They have purchased a number of gas heaters and cooking stoves, also engines, which are rented at a low rate, but sufficiently high to pay, to consumers.

Should consumers desire to purchase these gas-using appliances at any time, they may do so; and the half of what they have paid in rent for said appliances will be allowed as a discount to them on the purchase price. Simple, commonsense regulations are made to regulate this business, which seems to have worked to the entire satisfaction of corporation and consumers alike.

Since the gas-using appliances, other than those employed for illumination, are mostly used in the hours of daylight, when otherwise the street mains are comparatively idle, the corporation gives a rebate on all gas used in engines, stoves or heaters, with the result that the quantity of gas sold for other purposes than illumination has increased more than tenfold within six years.—F. E.

Development in the Calcium Carbide Industry.

The *Iron Age* says that recently two new companies have been organized in this State to do business in connection with the calcium carbide industry at Niagara Falls. One is to be known as the Union Carbide Company, and has a capital stock of $50,000. This Company is to be the successor of the Acetylene Light, Heat and Power Company, which Company were closed out under chattel mortgage foreclosure on March 28 last. The Union Carbide Company have purchased the plant and buildings of the Acetylene Light Company on the lands of the Niagara Falls Power Company, and will continue the manufacture of carbide. It is the announced intention of the Company to double the capacity of the plant in the near future. The second Company is to be known as the Carbide Lighting Company. They are capitalized in $100,000, divided into 1,000 shares. The Company is authorized to do business with $10,000. The Directors for the first year are Joseph P. Devine, of Buffalo, who for a long time was Manager of the old Acetylene Light, Heat and Power Company; J. B. Rice, of Cambridge, J. C. Frost and Thomas J. Wilcox, of Niagara Falls, and Frederick Overbury, of New York. The objects of the Company are stated to be the manufacture of acetylene lighting machinery and supplies. The Company will make generators for producing acetylene gas, also lamps and all kinds of supplies in connection with their field. It is stated that the Company controls the United States patents for making the Willson machines for generating gas, Mr. Willson being the discoverer of the carbide process. These generators are automatic. There are four sizes now made—25, 50, 75 and 100 lamps capacity. Until the local plant is ready, the generators will be made in the East.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

MONDAY, APRIL 18, 1898.

Searchlights.

Electricity says that in modern naval warfare the electric searchlight necessarily plays a very important part. Every man-of-war is provided with two or more of these powerful reflectors as a safeguard against the attack of torpedo boats or for signaling purposes. At harbor fortifications the searchlight is invaluable for detecting the approach or attack of an enemy by night. A search lamp, or that part of the apparatus which generates the light, is nothing more, as is well known, than a focusing lamp mounted in a cylindrical box so arranged as to send the beams of light in any desired direction by the aid of a reflector. Of the whole apparatus the latter is by far the most important. It is absolutely necessary to employ a reflector in order to obtain a parallel beam, and this reflector has up to the present time almost invariably been made out of glass. As it takes a number of weeks to accurately grind one of these glasses, a substitute has been widely sought for in the way of a metal reflector. Attempts have been made to obtain metal reflectors by spinning them in moulds, but it has been found impossible to spin them true. Cast metal reflectors have also been tried, but the cost of grinding and polishing them has been found excessive. Stamping has also been tried with equally poor results. Mr. Sherard Cowper-Coles, of England, suggested a rather ingenious method of making a reflector at a moderate cost electrolytically. In a word, his method consists in preparing a glass mould to form a true parabolic reflecting surface. It is only necessary to accurately shape and polish the convex side. Over the prepared surface a coating of metallic silver is chemically deposited. The mould is then immersed in an electrolyte of copper sulphate, and while slowly revolved, copper is deposited. The metal portion is then separated from the mould and coated with a film of palladium to prevent tarnishing. This process is said to give an excellent reflector at a moderate cost.

As previously stated, the main object of the reflector is to make the beam of light parallel. In practice, however, it is impossible to obtain a reflector which will not absorb some light or which will make a beam perfectly parallel. The light, therefore, gradually becomes scattered as the distance from the source increases, but in spite of this drawback powerful lights can be thrown under favorable conditions a distance of 100 miles.

In the larger forms of projectors the adjustment of the beam is accomplished by means of screws or gearing. Searchlights on ships are usually equipped in this manner. To enable the regular pressure, generally in use on ships, of 110 volts to be utilized for operating the searchlight, a rheostat is frequently placed in circuit with the arc lamp. Thus resistance can be either added or cut out at will.

The harbor fortifications in the vicinity of New York are well equipped with searchlights. Sandy Hook is provided with one, Fort Wadsworth has two and is said to be fully equipped for operating them, and Willetts Point also has an efficient plant of this nature. The searchlight at Sandy Hook is probably the largest in the world. It is the projector that was on exhibition at the Chicago Columbian Exhibition in 1893 and which attracted so much attention. It weighs 6,000 pounds and has a reflector of 5 feet in diameter. In operating it requires a current of 200 amperes at 50 volts, or in other words, takes an activity of 13.4 horse power. The upper carbon is 1¼ inches in diameter, the lower carbon ¼ inch less. This light is provided with a Mangin reflector, which is a spherical mirror whose inner and outer surfaces are of different radii. In this apparatus the light is not allowed to pass directly from the arc into the beam, but is thrown from the arc back to the reflector by means of a small mirror before being projected outward.

The best searchlight mirrors are said to be manufactured abroad, there being but comparatively few made in this country. There would therefore seem to be a wide field open in this line provided some economical process could be discovered for turning out this article.

Tensile Tests at High Temperatures.

Engineering says that some interesting experiments have been made at the Royal Technical Institute at Charlottenberg on the effect of heat on the physical properties of certain metals. The materials tested included iron, open-hearth steel, copper, samples of delta metal, both cast and forged; and finally manganese bronze containing different proportions of manganese. To secure uniformity in the results the specimens for a series of experiments on any particular metal or alloy were cut from a single bar. The tensile strength of each material was ascertained at ordinary temperatures, and at those of 212° F., 392° F., 572° F., and 752° F., three tests being made at each temperature with each of the metals save the manganese bronzes containing more than 3.2 per cent. of manganese. With these latter only two specimens were broken at each temperature. For temperatures up to 572° F. the test bars were heated in vapor jackets, which surrounded the specimen as it stood in the machine. For the temperature of 212° F. the vapor used was, of course, that of water, whilst for the temperature of 392° F. naphthaline vapor was employed, and for that of 572° F. naphthylamine vapor. In the case of the temperature of 752° F. the specimens were immersed in a bath of an alloy of lead and tin.

In each case the actual temperature of the bath, whether liquid or vaporous, was determined by means of a thermometer. The extensions of the bar under test were measured by a mirror micrometer. The conclusions reached by the experimenters were that in the case of iron it is necessary to attain a temperature of 572° F. before it can be forged, etc., without injury to its properties, whilst with an open-hearth steel a still higher temperature is necessary. Cast delta metal, it was found, should wrought at the same temperature, but in the case of the forged metal, a higher temperature is demanded. The manganese bronzes appeared to maintain their strength remarkably well up to a temperature of 482° F., and this alloy can certainly be taken as having practically the same resistance at 392° F. as at ordinary temperatures. The alloy giving on the whole the best showing was found to be that containing between 5 and 6 per cent. of manganese, and is the one recommended for use in practical engineering work.

The Market for Gas Securities.

The market for city gas shares about held its own last week, and although the changes were slight, the net result was in favor of the investor. Consolidated opened to day (Friday) at 178½ to 179, and there was some demand for it. Other city shares, save old Equitable, are steady. In the Equitable instance the old stock is quoted at 206 to 215.

Brooklyn Union is firmer, the opening to-day having been made at 111 to 111½. Peoples, of Chicago, shows no change. Laclede sold down to 40, on the finding of the Supreme Court in respect to the Company's charter rights, which decision was adverse to the Company on several points. Baltimore Consolidated is 59½ to 59¾, and Bay State is dull, at 3 to 3½. The general disposition of the market would seem to favor higher values throughout the entire list.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

APRIL 18.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,230,000	100	178¼	179
Central	500,000	50		..
" Scrip	220,000	..	100	.
Cental Union, Bonds, 5's	3,000,000	1,000	99¼	100
Equitable	4,000,000	100	206	215
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	,500,000	100	290	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	18,000,000	100	24	25¼
Preferred	10,000,000	100	63	64
Bonds, 5's	11,000,000	1,000	93	94
Northern	150,000	50	..	
" Bonds	150,000	1,000	..	
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River	5,000,000	100	81	83
Preferred	2,000,000	100	112	115
Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	106
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	128	132
Preferred	5,000,000	100	142	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	111	111¼
" " Bonds (5's)	15 000,000	1,000	112½	113
Bay State	50,000,000	50	3⅛	3¼
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	89	90
2d " " "	3,000,000	1,000	..	70
Buffalo City Gas Co.	7,000,000	100	25½	26½
" " Bonds, 5's	7,000,000	1,000	90	92
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,000,000	.	89	91
1st Mortgage	1,085,000	..	101	103½
Consumers, Jersey City	2,000,000	100	75	80
" Bonds	600,000	1,000	102½	105
Cincinnati G. & C. Co.	8,500,000	100	200½	201

Consumers, Toronto	1,000,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	59¼	59¾
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		59	61
" Con. Bonds	4,312,000	..	..	95
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	81
" Bonds	2,000,000	..	89	91
Hartford	750,000	25		145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 000,000	..	106	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	40	42
Preferred	2,500,000	100	85	..
Bonds	9,094,400	1,000	101½	102
Montreal, Canada	2,000,000	100	200	
Newark, N. J., Gas Co	1,000,000	..	200	220
Bonds, 6's	4,000,000		128	130x
New Haven	1,000,000	25	252	..
Oakland, Cal	2,000,000	..	53¼	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	91½	91¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples. Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..		
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	2,500,000	25	17	19
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	77	78¼
Bonds, 5's	3,556,000	.	102½	103½
Wilmington, Del.	550,000	50	200	

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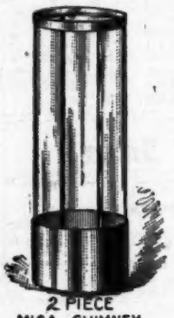

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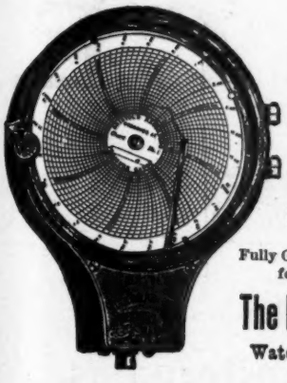

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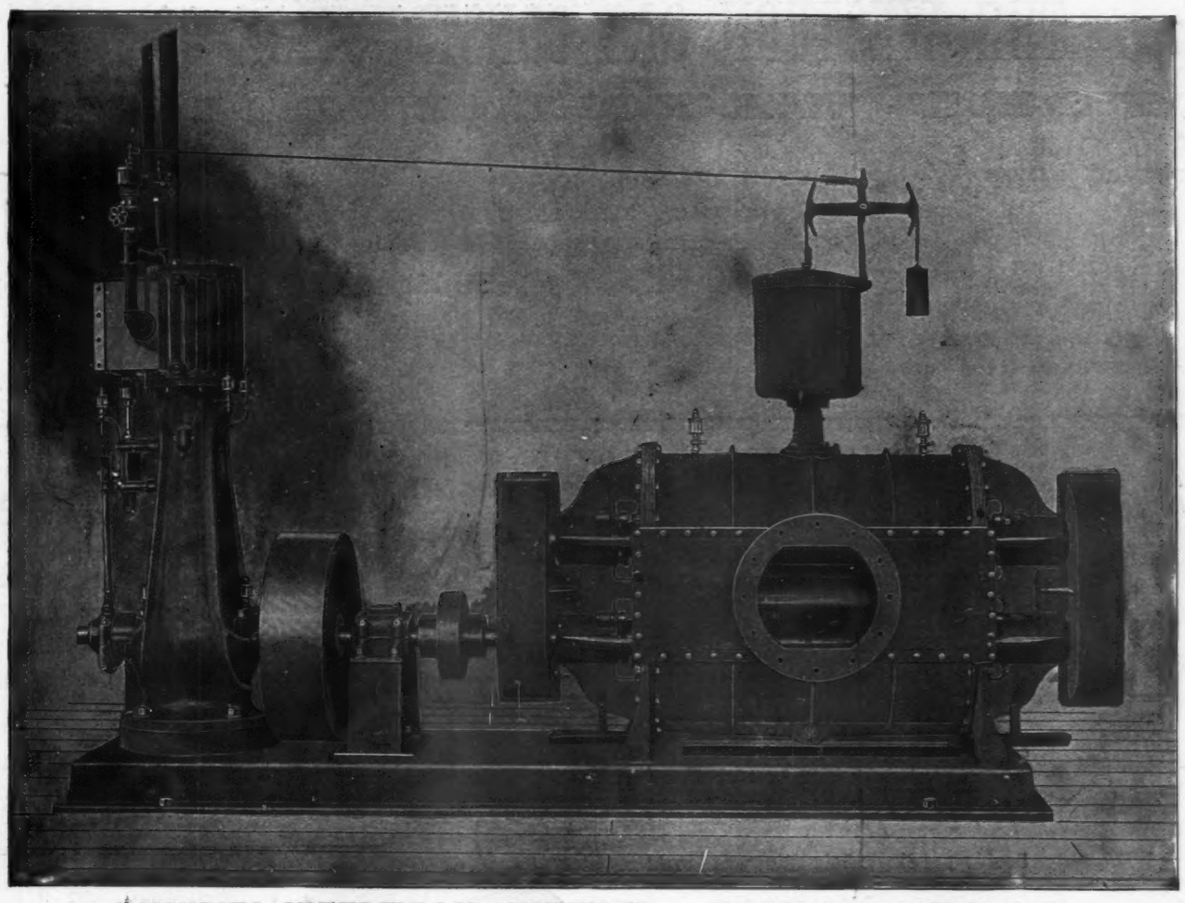

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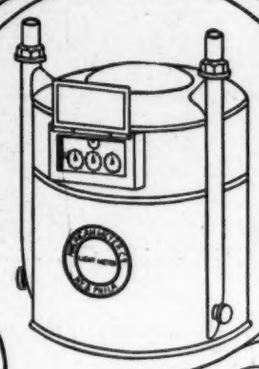

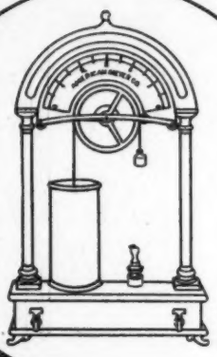

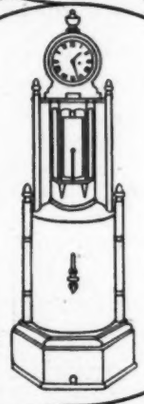

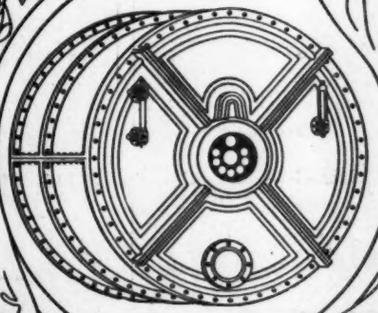

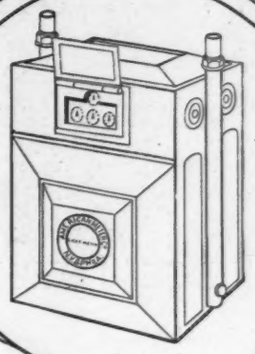

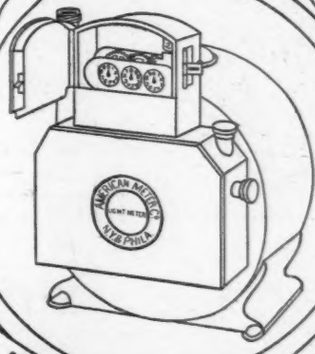

PUBLIC LIGHTING TABLE.

MAY, 1898.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	1.30 AM	4.00 AM	6.45	4.00
Mon.	2	2.00	4.00	6.45	4.00
Tue.	3	2.30	4.00	6.45	4.00
Wed.	4	No L.	No L.	6.45	4.00
Thu.	5	No L. FM	No L.	6.45	4.00
Fri.	6	No L.	No L.	6.45	4.00
Sat.	7	7.30 PM	10.10 PM	6.55	3.40
Sun.	8	7.30	11.20	6.55	3.40
Mon.	9	7.30	12.10 AM	6.55	3.40
Tue.	10	7.30	12.50	6.55	3.40
Wed.	11	7.30	1.30	6.55	3.40
Thu.	12	7.30 LQ	2.00	6.55	3.40
Fri.	13	7.30	2.30	6.55	3.40
Sat.	14	7.30	2.50	7.00	3.30
Sun.	15	7.40	3.10	7.00	3.30
Mon.	16	7.40	3.40	7.00	3.30
Tue.	17	7.40	3.40	7.00	3.30
Wed.	18	7.40	3.40	7.00	3.30
Thu.	19	7.40	3.40	7.00	3.30
Fri.	20	7.40 NM	3.40	7.00	3.30
Sat.	21	7.40	3.40	7.10	3.15
Sun.	22	7.50	3.40	7.10	3.15
Mon.	23	7.50	3.40	7.10	3.15
Tue.	24	7.50	3.40	7.10	3.15
Wed.	25	10.20	3.40	7.10	3.15
Thu.	26	10.40	3.40	7.10	3.15
Fri.	27	11.10	3.40	7.10	3.15
Sat.	28	11.30 FQ	3.40	7.15	3.15
Sun.	29	12.00	3.30	7.15	3.15
Mon.	30	12.20 AM	3.30	7.15	3.15
Tue.	31	12.50	3.30	7.15	3.15

TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45

Welsbach Patent Sustained.

INJUNCTION GRANTED.

JUDGE TOWNSEND, in the United States Circuit Court for the Southern District of New York, has handed down a decision sustaining the Welsbach Light Company's Rawson Patent, and adjudged the Sunlight Incandescent Gas Lamp Company to be an infringer. This Company has been enjoined from the further use of its method of manufacture of incandescent mantles, and ordered to render an accounting.

Every other manufacturer of incandescent mantles in the United States is, under this decision, an infringer of this patent, and the Welsbach Light Company will proceed against them at once.

We again caution gas companies and the public generally against the purchase of any incandescent mantle other than that made and sold by the Welsbach Light Company or its agents.

Every genuine Welsbach lamp has the trade mark "Welsbach" conspicuously printed upon the package and upon the burner itself.

Dealers desiring to handle the genuine article should communicate with the

WELSBACH COMMERCIAL CO.,

Drexel Building, Philadelphia.

The United Gas Improvement Company,

Since originating and developing

The Standard Double Superheater, and

The Standard Junior,

LOWE WATER GAS APPARATUS,

Has installed, up to January 1, 1898,

242 Sets—Daily Capacity, 128,475,000 Cu. Ft.

Has under contract, since January 1, 1898,

8 Sets—Daily Capacity, 7,750,000 Cu. Ft.

And is now building in its OWN WORKS

apparatus of the SAME TYPE,

20 Sets—Daily Capacity, 36,000,000 Cu. Ft.

Total Built and under Construction,

270 Sets—Daily Capacity, 172,225,000 Cu. Ft.

The United Gas Improvement Company,

DREXEL BUILDING, PHILA., PA.

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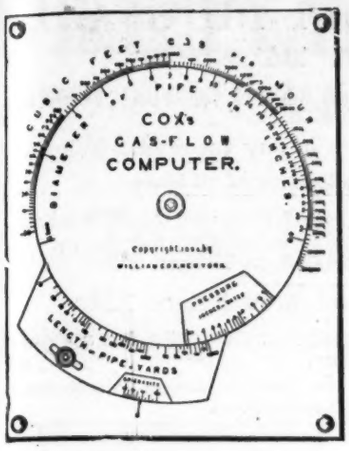

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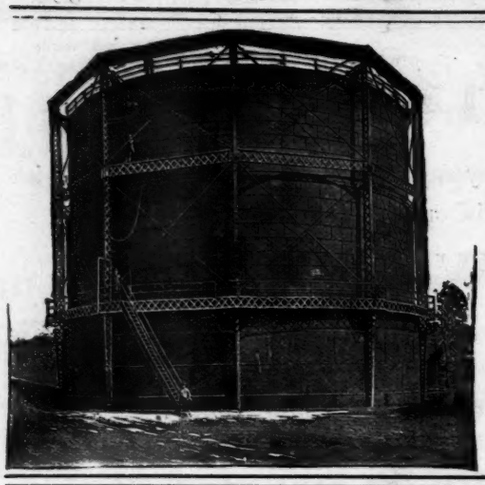

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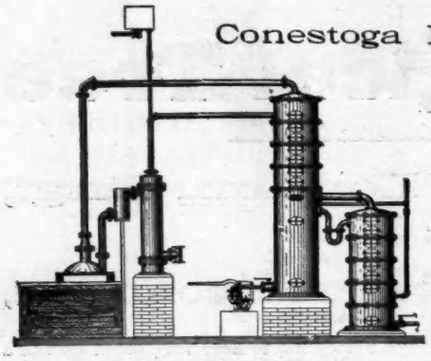

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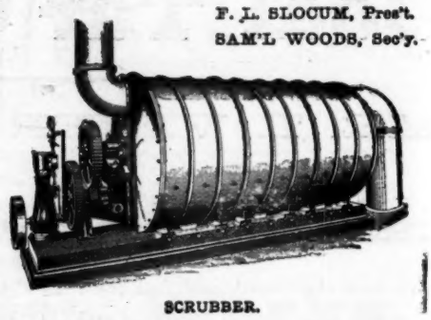

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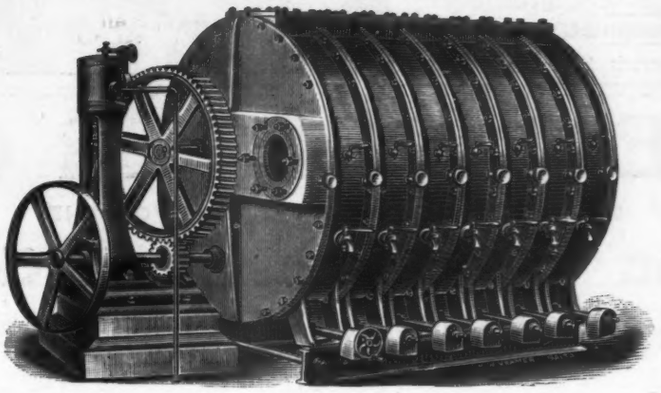

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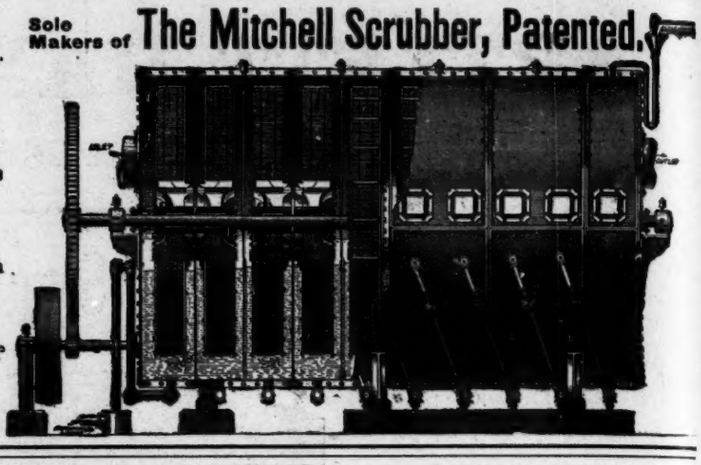

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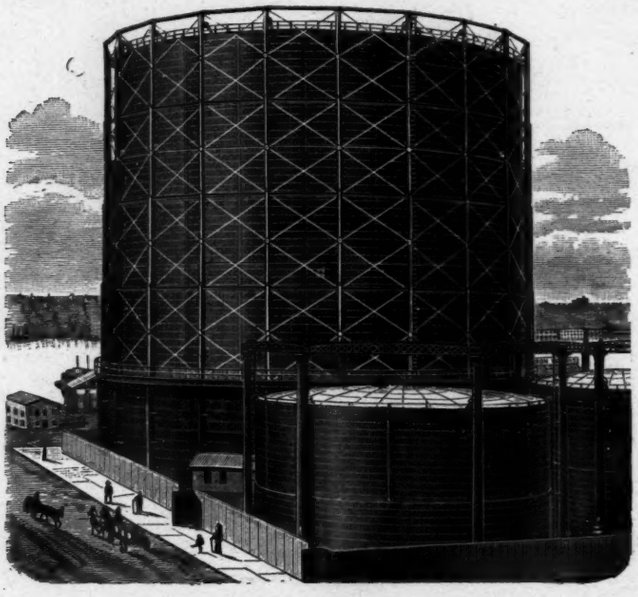

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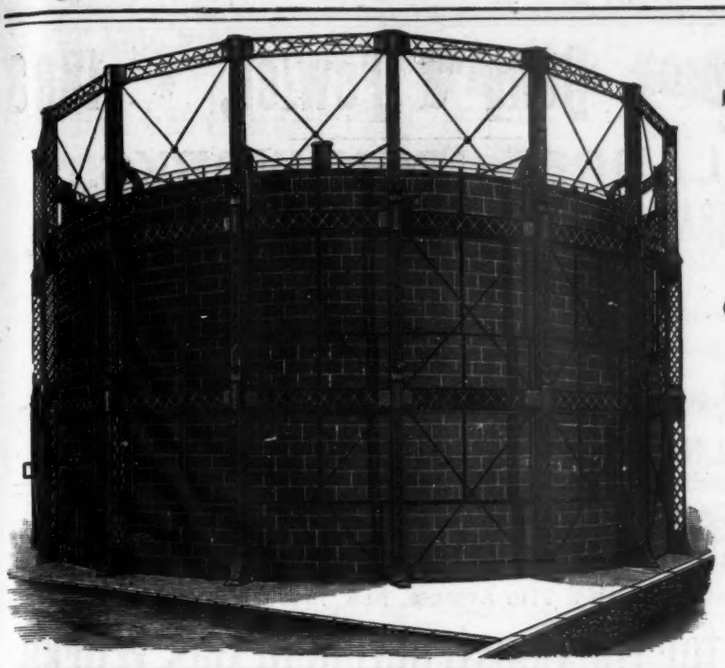

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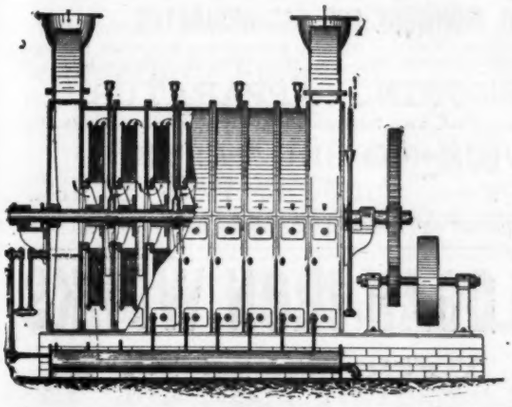

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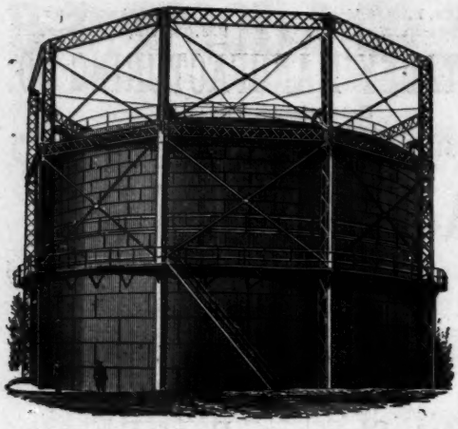

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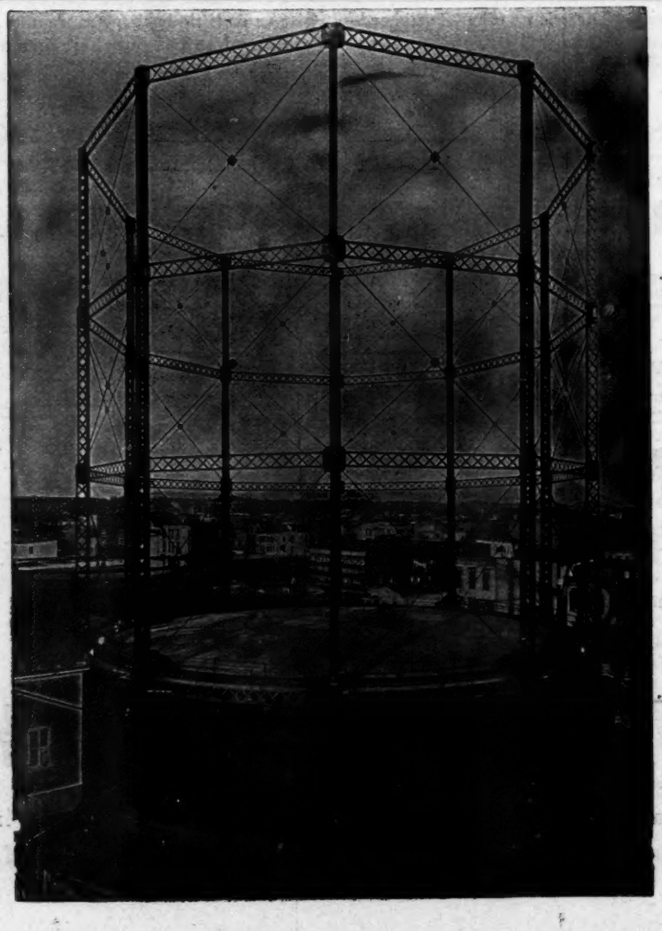

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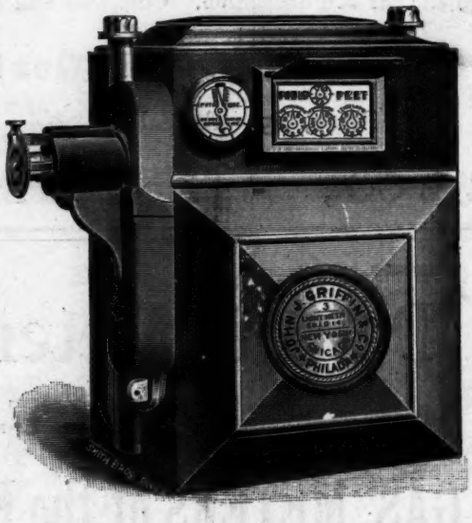

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